# The FOUNDRY

Volume 55
Number 1

Published
Semimonthly

CLEVELAND, OHIO, JANUARY 1, 1927


## Castings Aid in Clearing the Wreckage

WINTER, with its frigid temperatures, always has been a source of great trouble to any medium of transportation. The annual battle between the elements and the products of man's inventiveness continues, but each year the snow and ice seem a trifle less troublesome. Back in the early days of the automobile, few thought of driving during the cold months. Today perfections in machines and the tendency of removing snow from main traveled highways have ushered in an era of all year

**With Cranes, Jacks, Dollies and other Equipment, the Modern Wrecking Car Is Fitted To Haul Smashed Cars to the Garage**

driving. However, dangers accompanying winter driving have increased, due in part to the large number of cars on the road and statistics show that automobile accidents increase greatly when the snow comes. Handling wrecked automobiles has developed into a science with practically every first class garage maintaining wrecking cars ready to answer calls during the day or night. These cars are equipped with cranes having a capacity as high as 5 tons, which pick up one end of a disabled car and drag the work to the repair shop. The cranes are especially designed for this work and are adjustable for height and overhang. The product of the foundry is found on these emergency cars, for castings are used for many of the crane parts, for the heavy jacks and the dollies.

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PUBLISHED BY THE PENTON PUBLISHING CO., CLEVELAND, O.

BRANCH OFFICES

BOSTON ..... 1037 Old South Bldg.
CHICAGO ..... 1147 People's Gas Bldg.
CINCINNATI ..... 209 Edwards Bldg.
NEW YORK ..... 2203-2206 No. 220 Broadway
PITTSBURGH ..... 2148-49 Oliver Bldg.
SAN FRANCISCO ..... 24 California Street
WASHINGTON, D. C. ..... 1653 Pennsylvania Avenue

FOREIGN OFFICES

BIRMINGHAM, ENGLAND ..... Prince's Chambers
LONDON, ENGLAND ..... 2-3 Caxton House Westminster, S.W.I.
PARIS, FRANCE ..... No. 9 Rue de Londres
BERLIN, GERMANY ..... Kurfurstendamm 136. Berlin-Halensee

*Cable address, IROTRAPEN, London*

SUBSCRIPTION

United States and Mexico ..... $3.00 a year
Canada ..... $4.00 a year
Great Britain and other Foreign Countries ..... £1:0:0 a year
Single copies ..... 25 cents

Copies published three months or more previous to date of current issue, 50 cents each

Member, Audit Bureau of Circulations, Associated Business Papers, Inc., National Publishers Association

Entered at the Post-office at Cleveland as Second Class Matter



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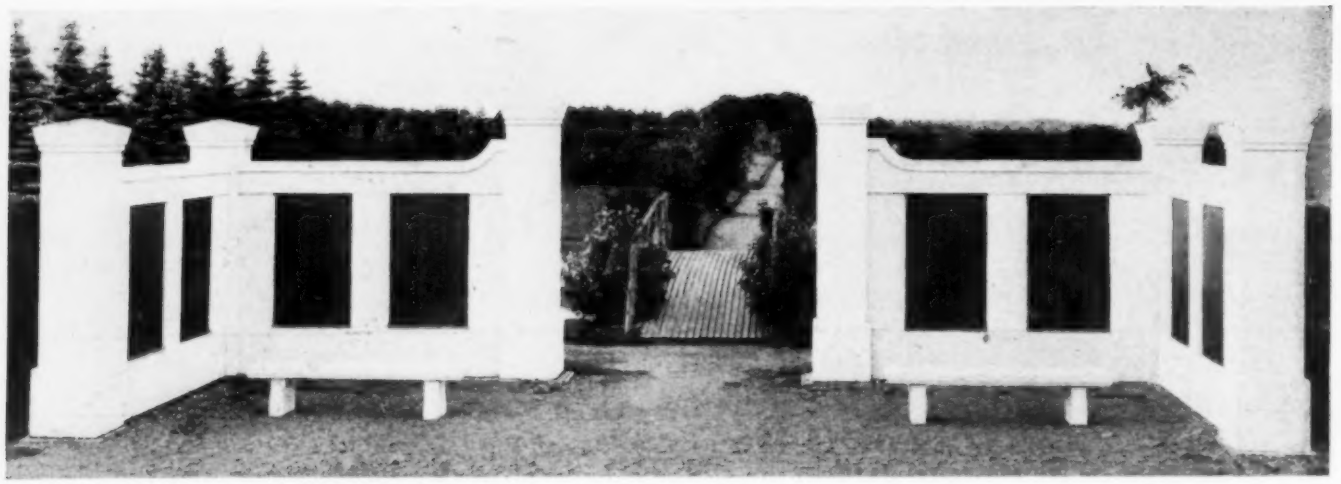


# *BRONZE TABLETS*
# Mark Historic New England

By Herbert R. Simonds

HORDES of automobilists, who travel the highways of New England each summer, find that many points of historical interest throughout that section of the country are marked carefully with beautiful and enduring bronze tablets. Many of these tablets represent art work of the highest order and practically all stand as a monument to the skill of the New England foundries engaged in this work. A specialized branch of the foundry industry has been developed which is devoted to casting ornamental bronze work and a further subdivision has been made in this field to give particular attention to bronze tablets. Although the demand for these tablets is surprisingly large, the total tonnage represented is comparatively small and is produced by a limited number of foundries. One plant engaged in this work is the Albert Russells Sons Co., Newburyport, Mass. This company was organized as a gray iron foundry in 1840 and has been in continuous operation since that time. In 1900 a bronze foundry was added which has developed a speciality of bronze tablets. these tablets or markers are sent from Newburyport to all parts of the country and the company particularly is proud of having over 500 tablets on the battlefield of Gettysburg. Much of the work of this plant in recent years has been for tablets commemorating world war events and the heroes who participated.

*Many Points of Interest Are Marked With Bronze Tablets*

Making bronze tablets is a relatively simple matter, according to Norman Russell, who is in charge of this work. However, a short investigation shows that there is more to the art than firsts meets the eye. The order for the tablet usually arrives in the form of a rough sketch with a typewritten inscription. The idea first must be worked into a tentative design and a proof or rubbing sent to the customer for approval. A large stock of pattern letters must be carried by the foundry. The usual varieties of type used include the plain block, Gothic, architectural and Roman. The foundry at Newburyport carries a full line of these letters. The letters are attached to the pattern with shellac. Sometimes the board first is covered with pebble cloth to give a stippled background effect. Decorative

features usually are modeled first in wax and then are cast in plaster of paris. The plaster model then is mounted on the pattern board. An artist is a necessary part of the foundry personnel since he does the plaster work. Another duty which usually falls to the artist is the selection of the size of type, when it is not indicated in the order, and the arrangement of the letters for balance and symmetry.

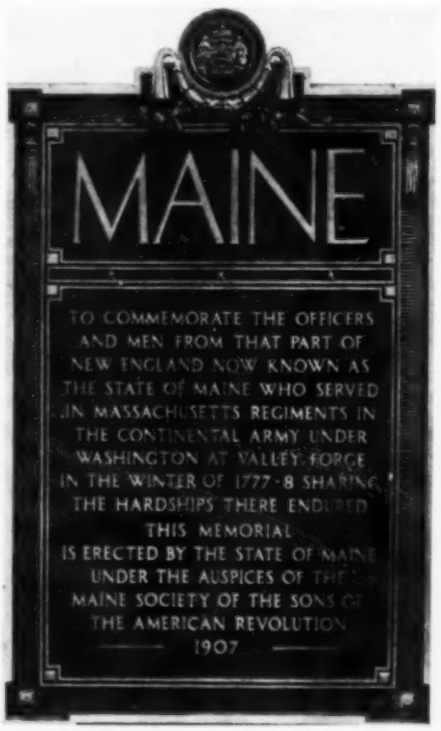
A plain tablet, such as the one shown attached to a large granite stone in the illustration at the right, constitutes a fairly easy casting job, provided that the foundry is equipped to handle this type of work and has a background of experience. After the pattern has been made and the letters carefully shellacked, the pattern is sent to the foundry. The procedure in casting the tablet is the same as in any high grade bronze work.

It is necessary that the metal be hot and fluid to fill the letters completely. A composition known as statuary bronze most frequently is used, as this mixture runs well when the metal is being poured and is satisfactory from the standpoint of performance and appearance requirements. The alloy has a composition of about 90 per cent copper, 7 per cent tin and 3 per cent zinc with a small amount of lead.

Buyers of tablets frequently specify U. S. standard bronze. This is a misnomer, for various governmental departments have specifically stated that there is no U. S. standard bronze. A standard metal, which is known as composition G or as gun metal, consists of 88 per cent copper, 10 per cent tin and 2 per cent zinc. However, experience has shown that less than 90 per cent copper may result in stains at the base of the tablet when it is used on marble or granite. Unless the tablet contains a complicated ornamental design, the face of the tablet is tamped carefully in the drag with fine sand. Some foundries use French sand and in most all cases a small amount of molasses is used. When the mold is finished it is baked thoroughly. Frequently it happens that an elaborate ornamental design is the feature of the tablet. In such cases the work often is sent to a sculptor of standing, who models either part or all of the tablet in wax and then makes his plaster cast, which is used at the foundry as the pattern. With the artistic features uppermost in his mind the sculptor is likely to make his design, and therefore his pattern, in such form that it is exceedingly difficult to cast. However, the foundry in this line of work takes every design as it comes.

*Cast Bronze Tablets Harmonize With Rough Granite Boulders*

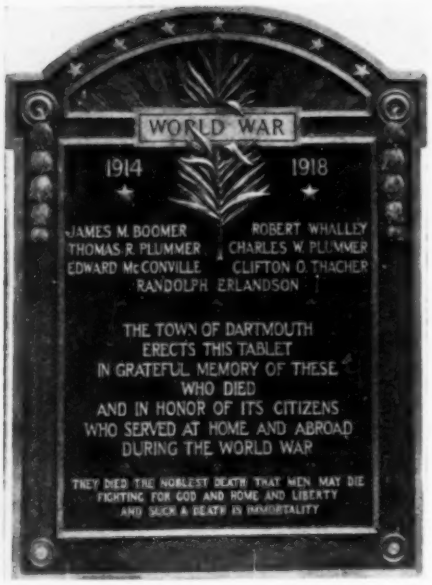
The chief difficulty arises in connection with the undercuts or overhanging projections. When this is the case cores are made carefully to fill the spaces under the projections, and after the sand has been rammed up, these cores are removed to permit the removal of the pattern itself, after which the cores are replaced. Care is required in molding these cores, some of which are exceptionally small. It is not uncommon to have a piece require small section cores completely encircling it. Each core must be made to conform to the contour of the pattern, and also must be designed so that its may be replaced accurately after the pattern has been withdrawn.


MAINE
TO COMMEMORATE THE OFFICERS
AND MEN FROM THAT PART OF
NEW ENGLAND NOW KNOWN AS
THE STATE OF MAINE WHO SERVED
IN MASSACHUSETTS REGIMENTS IN
THE CONTINENTAL ARMY UNDER
WASHINGTON AT VALLEY FORGE
IN THE WINTER OF 1777-8 SHARING
THE HARDSHIPS THERE ENDURED
THIS MEMORIAL
IS ERECTED BY THE STATE OF MAINE
UNDER THE AUSPICES OF THE
MAINE SOCIETY OF THE SONS OF
THE AMERICAN REVOLUTION
1907

*Tablets Commemorating the American Revolution Still Are Being Erected*

In making the mold for an undercut wreath or scroll it often is found advisable to make the core pieces form sectors of a circle of larger diameter. In this way each core piece has its position definitely located between two other core pieces, and has a flat resting surface sufficient to give stability. This general arrangement is shown in an accompanying illustration.

After the tablets are taken from the sand, they are cleaned with small electric revolving brushes and then are finished in one of a number of different

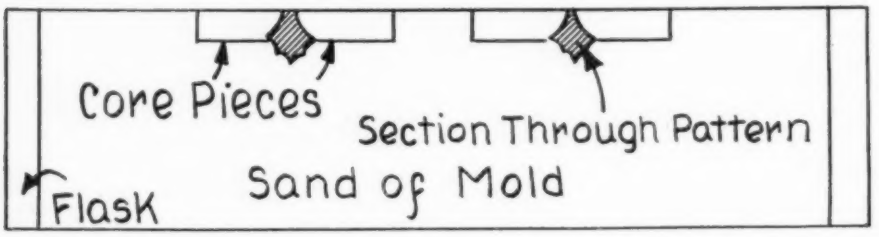



*Bronze Memorials to World War Heroes Are Found in Many Towns*

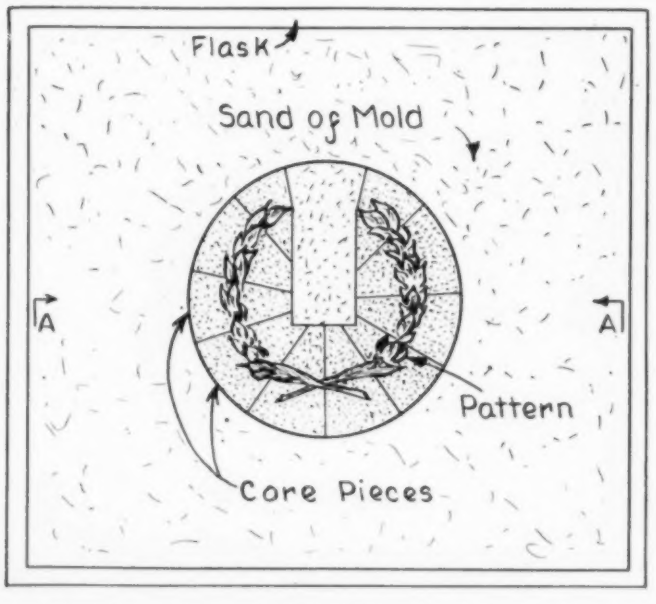
ways. Usually the face of the letters is filed or ground with a portable grinder. An experienced man is then put at work touching up the ornamental work and turning the edges of the letters. This is hand work done with special tools. The tablet frequently is made in different colors, although, for outdoor use, the natural shade of the bronze is recommended. Varying shades to match other bronze work or rolled bronze forms are obtained by altering the composition of the metal. The skilful melter will be able to match almost exactly any shade within a fairly wide range between copper and dark gun metal.

Although ornamental bronze tablets would seem to fall in an artistic class and thus be free from severe competition, this actually is not the case. Foundries making these tablets are forced to bid against one another and prices, therefore, are low. A tablet of the form shown attached to the granite rock, size 24 by 30 inches costs about $125. As a rule the price averages $25 per square foot. When special sculptor's work is required, an additional charge is made, although even here the same rules of competitive bidding usually apply.

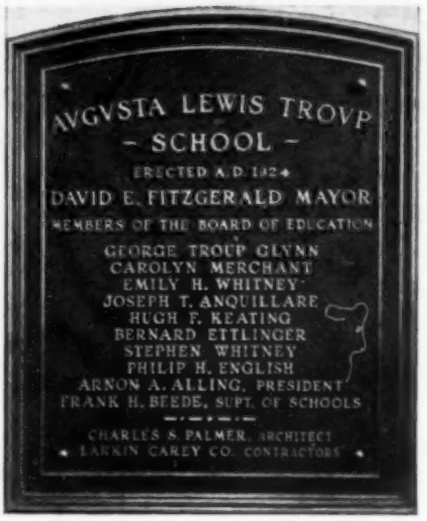
The permanence of bronze tablet work—the fact that castings produced in the foundry are mounted in schools, churches, parks and at hundreds of roadside points of historical interest—lends a fascination to the industry independent of any monetary consideration. Government tests indicate that monument bronze should withstand the elements for thousands of years, which is a longer life than that expected of most foundry products.




*Cores Are Used in Overhanging Patterns To Permit Withdrawal of the Pattern from the Sand*




*Wreaths and Scroll Work Usually Require Cores*




*Bronze Tablets Frequently Are Placed in New Buildings*

## To Hold Exhibition

Plans have been completed for the national lighting equipment exhibition to be held in Cleveland from Jan. 31 to Feb. 4 under the direction and management of the Artistic Lighting Equipment association. The exhibition and convention committee consists of Fred R. Farmer, president, Beardsley Chandelier Mfg. Co., Chicago; O. E. Moe, sales manager, Moe-Bridges Co., Milwaukee; N. W. Belmuth, treasurer, Shapiro & Aronson, New York; J. S. Jaffe, president, Perfeclite Co., Cleveland and G. P. Rogers, managing director of the association, Cleveland.

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BY THE OFFICERS AND CREW OF THE
UNITED STATES SHIP SALEM
IN APPRECIATION OF COURTESIES SHOWN
DURING OLD HOME WEEK 1909

*Many Tablets Have Highly Ornamental Designs*

# Casts Iron Pipe

## In Spinning Green Sand Molds

*Comprehensive Sand Preparation and Conveying System Supplies Molding Machines—Sand Layer Is Reamed from Around Poured Pipe*

By Dan M. Avey

**This is the second of two articles covering the method of making cast iron pipe at the plant of the American Cast Iron Pipe Co., Birmingham, Ala.**

USING the known capacity of the casting machine as a basis, and adjusting the entire plant to the requirements of twelve units, W. D. Moore has built up a carefully planned plant, which perhaps best may be visualized by taking the sequence of operations and following the sand first, then the metal and finally the finished pipe castings through the various steps.

A comprehensive system has been developed to handle the sand required for molding. This system is self-contained and depends for its effectiveness on keeping the sand in motion, mixing it through continuous travel, assisted at various stages by riddling and with only temporary stoppage at a central tank and delivery bins or tanks at the molding stations. The capacity of the entire system, built by the Link-Belt Co., Chicago, is about 25 to 30 cubic yards per hour.

When the hot sand is removed from the molds, in a manner which later will be explained in detail, it is bone dry and has a temperature which varies from 300 to 500 degrees Fahr. It drops into a bin holding about 15 cubic yards from whence it is taken at the bottom through a variable, valve-type, opening and dropped upon a reciprocating conveyor. At this stage it is too hot to permit the addition of water for tempering. Accordingly, as it is carried along on a level in the basement, by a reciprocating conveyor, sufficient tempered new sand is added to bring the temperature down to about 175 degrees. This with the aerating effect of the conveyor, brings it to a state where a thin slurry or claywash, prepared in a muller made by the National Engineering Co., Chicago, is added. As the sand travels along, stopping intermittently, as the hinged blades of this conveyor reverse their direction of travel, the claywash is added in an ingenious manner.

Clay slurry is delivered to a tank, filled to the edge of an opening the width of the conveyor channel beneath. A lip on the lower edge of the opening and of the same width permits the claywash flowing over the edge to spread evenly upon the small heap of sand immediately below. A displacement cylinder, of a diameter just sufficient to permit it to slide downward into the claywash tank is balanced by an hydraulic cylinder so that the displacement cylinder slides downward into the claywash tank when a needle valve is opened in the hydraulic cylinder. This trickle can be adjusted as needed and the weighted cylinder pushes downward causing a flat sheet of claywash to flow over the edge of the lip and drop upon the sand.

From this place the sand is moved forward intermittently and dropped into the boot of an elevating conveyor belt which carries it upward on a rise of about 1 foot in a travel of 2 feet to the hopper of an oscillating riddle where the sand and large particles are removed, and thence to a relaying tank similar to others which will be described. This holds about 300 cubic feet of sand. At this point the sand is in a semi-tempered state and lacks the final necessary addi-

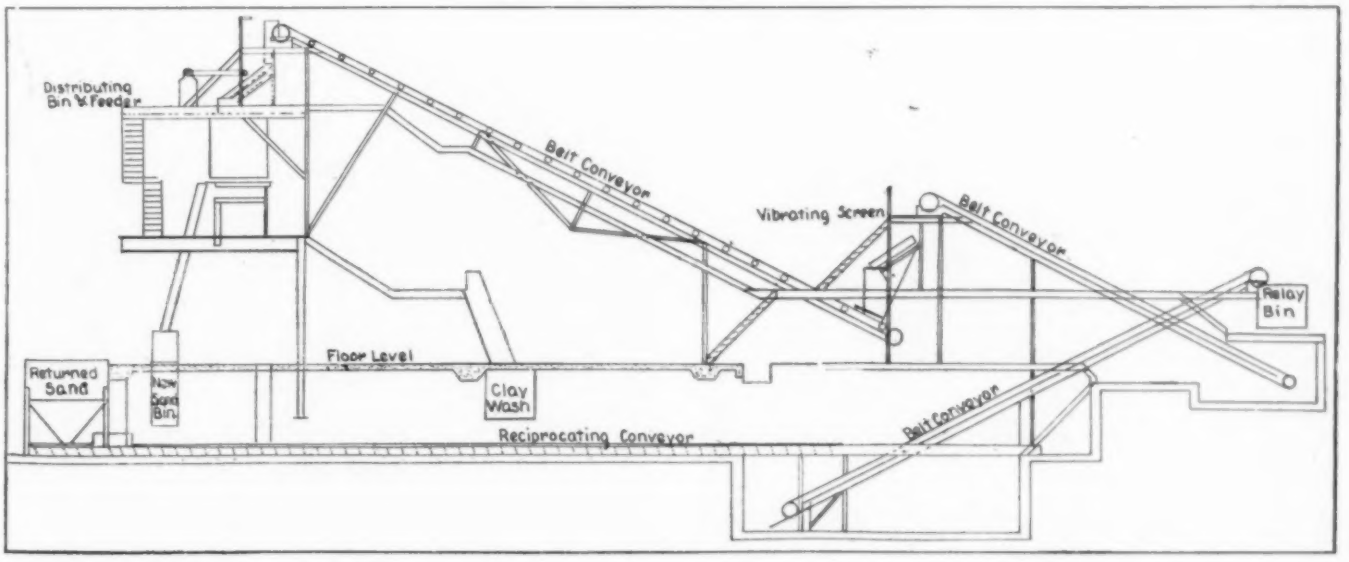



*Fig. 9—Returned sand is conveyed beneath the floor to the right, elevated to a cylindrical bin and then elevated again, traveling to the left through two stages to the central supply tank*

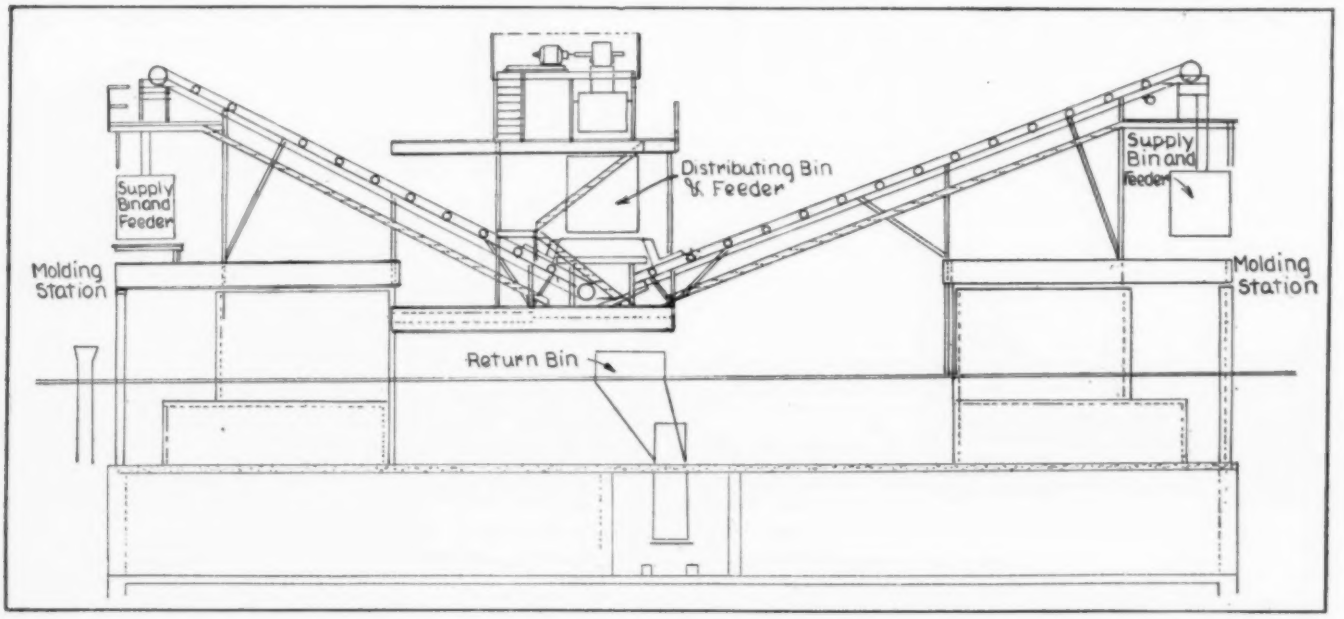
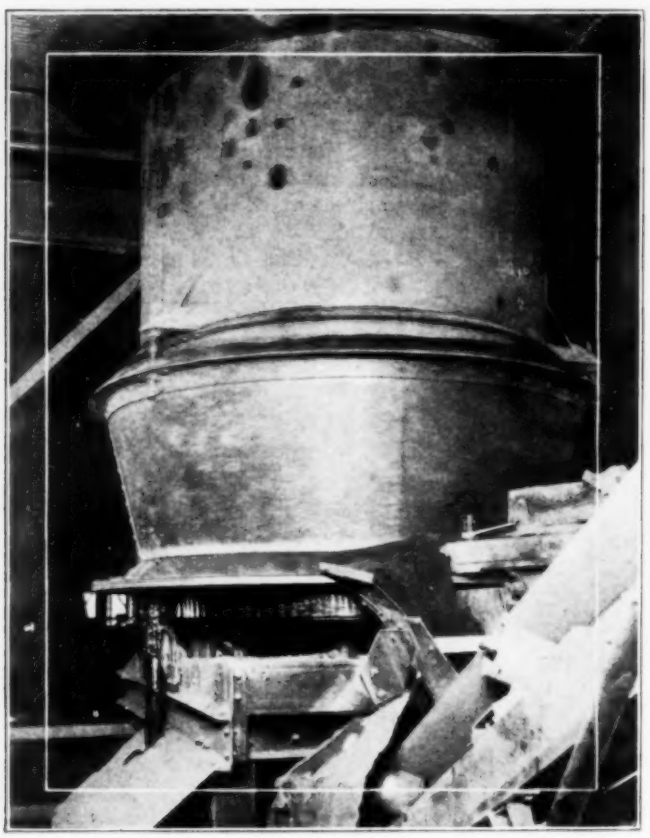



*Fig. 10—From the central tank the sand is carried to the left or right to either one of the two molding stations, or may be diverted back to the start of the system at the discretion of the operator*

tion of moisture. As it leaves the bin the excess heat has been eliminated. The clean sand dropping through upon a second elevating belt is carried back in the direction from which it came. This stage of travel, over a second elevating belt, delivers the sand into a second vibrating screen from which it drops into a vertical, cylindrical tank, placed high in the center of the shop and midway between the two molding stations which serve the two batteries of casting machines mentioned at the beginning of this article.

The cylindrical tanks are worthy of special description. The second of these is high up in the center of the shop. Two others are at each of the mold making stations. The central tank has a capacity of 180 cubic feet and each of the other five, 100 cubic feet.

The central tank similar to the others, is supported upon a circular base, about the circumference of which is a ring gear. An opening about 4 inches wide extends entirely around the lower circumference. A motor



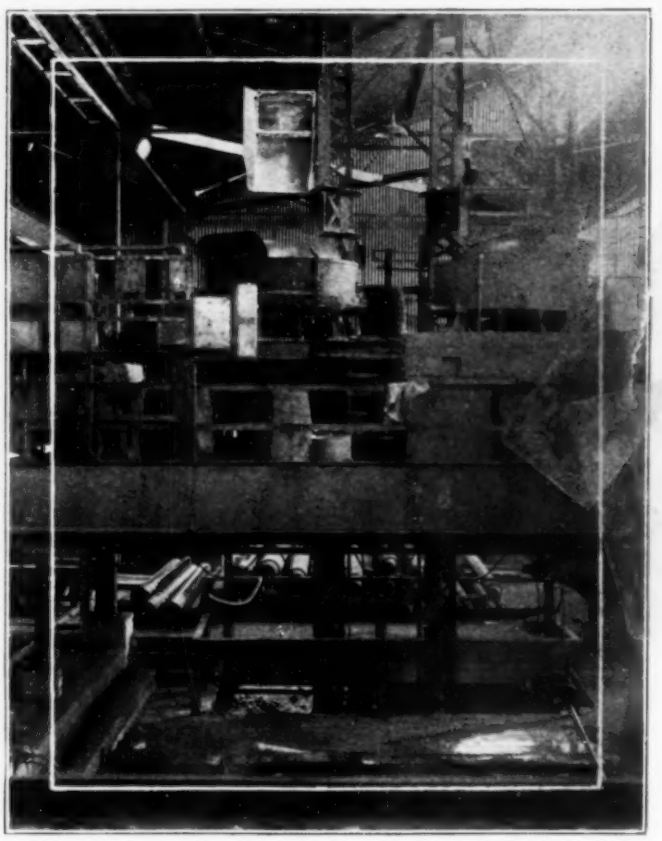


*Fig. 11—Rotating supply bins, or tanks are used at various points in the system. The central supply tank shown is feeding the elevating belt at the right. Fig. 12—Two mixers supply the sand for all cores and the clay wash for conditioning the molding sand. These are located on the molding stations*

driven pinion engaging the ring gear serve to revolve the tank continuously at a speed of 4 revolutions per minute. As the sand is delivered over the entire open surface of the tank, and is removed from the outer edge at the bottom, it must travel through the tank downward in a vertical direction and much of it also must work to the outer edge, making the travel the path of a spiral around the outer surface of a cone. When it reaches the bottom, the sand is scraped off by either of three adjustable plows, which may be changed to deliver varying amounts of sand to either of two elevating belts discharging at the molding station tanks or if necessary to a chute carrying the sand to the basement. In the latter case, the sand re-enters the system as previously described. This arrangement permits control of the amount of sand which is being carried to the two pairs of storage tanks at the molding stations. If either side is receiving too much sand, the quantity may be reduced or stopped entirely by adjusting the plows beneath the central revolving tank.

A careful control of the sand condition is maintained throughout the operation. Starting originally with a

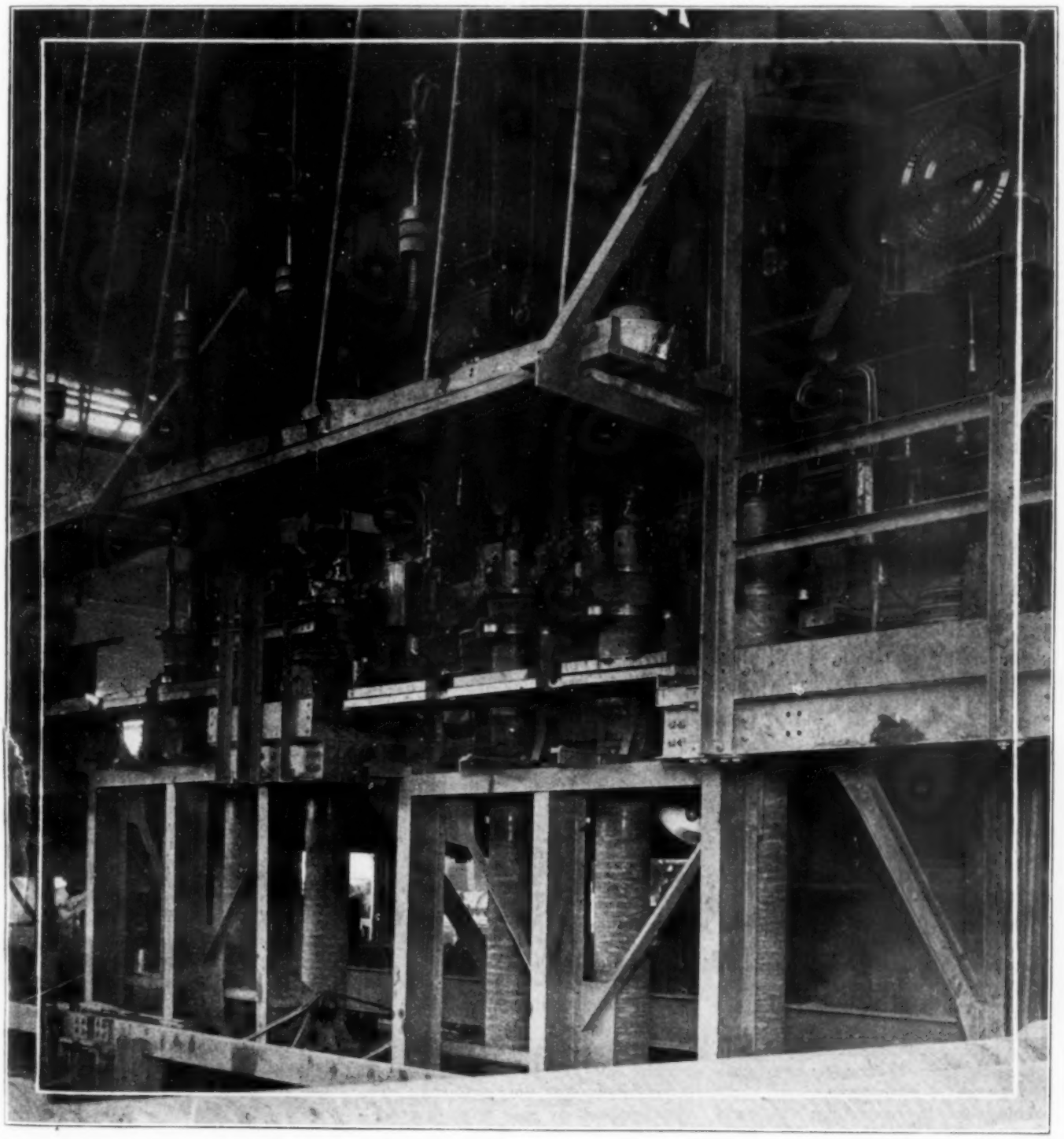


*Fig. 13—One of the two molding stations, each comprising two units on which three pipe are rammed simultaneously. The flasks have been up-ended on the tilting tables, the patterns are in place and the chutes from the two sand tanks above are ready to swing into position. Note the cables with yokes attached for pulling the patterns and the counterweights in the foreground which balance the pneumatic rammers. Extra flasks are shown in the lower foreground. These are rolled forward as needed, upon the table*

red loam molding sand from the Montgomery, Ala., district, additions of washed silica sand and claywash serve to maintain a constant quality when the sand is carried through the reciprocating conveyor to the middle of the floor and is elevated to the first tank when the direction of movement is changed. A quick test is made for permeability, moisture and bond. Also careful laboratory checks are made at intervals governing these factors and also grain size. Curves are plotted from the base into chutes. The latter deliver through tilting spouts which are swung forward over the flasks when the latter are in position for ramming, in a manner that will be described.

Each of the two molding stations has a capacity for two units of three pipe each. The flasks, three at a time are clamped horizontally on tilting tables, constructed of heavy structural members with the spigot end of the flasks toward the molding sta-

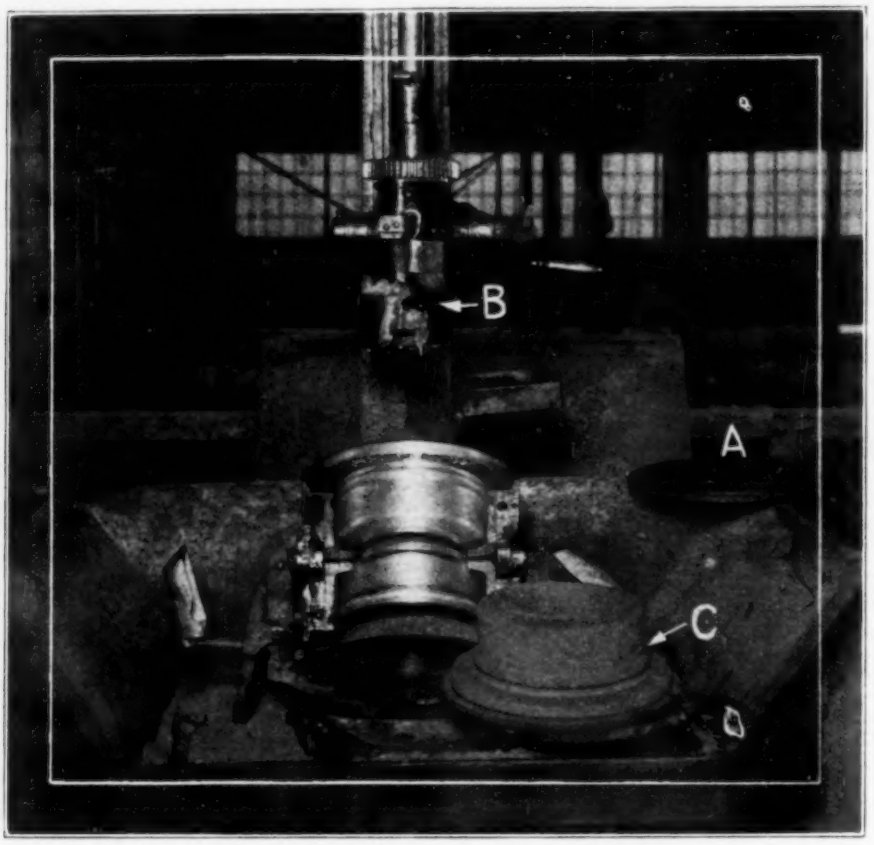



*Fig. 14—Core machines equipped with a hinged two section corebox are used. The head is dropped, and the sweep shown at B is rotated by turning the crank at the right. A completed socket core C rests on the coreplate where it has been swung out on a pivot. The vented coreplate is shown at A*

which in relation to the losses give data upon which to base sand control practice. The claywash is made from an ordinary yellow field clay.

Quantities shown by a comparison of the control curves, according to American Foundrymen's association standards show permeability maintained at about 400, moisture from 6 to 8 per cent, cohesiveness about 26 and a fineness which permits not more than 20 per cent to pass through an 80-mesh sieve.

This care in controlling the sand condition has removed one variable factor from consideration in the centrifugal, sand-cast method of making pipe.

The four tanks at the molding stations deliver their contents radially tion. The table containing three flasks is tilted by hydraulic power, lowering the spigot ends of the three flasks into a pit, until the flask ends rest upon a stool. The three flasks in this position are concentric with and beneath the pipe patterns held aloft on strong cables near the roof of the building.

The flasks rest upon stools in the center of which are conical and concentric holes to locate the lower or spigot ends of the patterns. The upper portion of each flask is provided with a ring, machined to accommodate steady rests. The steady rests are hinged and provided with rollers, to permit the flasks to turn concentrically, but still held firmly in a vertical position. These rests are swung around to clasp the upper portions of the flasks and hold them vertical. The patterns are lowered into the flasks, the conical ends being located in the recesses upon the stools supporting the flasks. The cables holding the patterns then are released and raised out of the way. Each flask is provided with a funnel-like hopper fitting into the bell end of the flask and the tilting spout connecting with the chute from the sand tank above is brought into position.

Next the stool upon which each flask and pattern rests is started revolving slowly, a stream of sand, deflected from the edge of the supply tank above falls through and a pneumatic rammer with a shank long enough to reach to the bottom of the flask, operated by a cable suspended and counter-weighted, is started. The sand space between the pattern and inside of the flask, about 1½ inches thick, is rammed tight.

### Pattern Pulled Through

The pattern for the body of the pipe fits down upon the stool in the manner mentioned. The coinciding portion of the stool is the pattern for the bead of the pipe, the body pattern fitting into the bead pattern, exactly where the bead starts off the straight part of the barrel.

The ramming proceeds as mentioned until the entire length of the flask has been filled. The pattern for the body then is pulled through the finished mold by cables connecting through yokes to the upper ends of the patterns. An electric motor operates the three cables drawing all three patterns simultaneously.

Next a funnel is set in place over the bell end of each mold. This funnel, provided with a spring closing dasher in the bottom is filled with the required amount of liquid facing. The dasher throws the facing outward and spirally so that it covers the inside of the pipe mold as it falls to the bottom. The steady rests then are released from the flask, the tilting table lifts them off the stools at the bottom and the table, which is carefully counterbalanced, lowers the three molds to a horizontal position.

### Flasks Retain Heat

In continuous operation each of the flasks comes to the molding station at comparatively high heat. The flasks are liberally provided with vent holes and some steam is visible from the moist sand within. These warm flasks serve to dry the sand slightly. Torches used at both the bell and spigot ends serve to intensify this drying at the ends.

A bell or socket core, carried on a

plate, is inserted in each pipe when the flask is delivered to the casting machine, and the plate is clamped to a flange on the flask. A retainer ring or stopoff, against which the end is cast and which is lightly faced with sand is affixed to each spigot end and the completed molds are rolled along a pair of rails placed at right angles to the pipe molds where they rest on the tilting tables and the ends are skin dryed as mentioned. The molds are rolled out on these rails until they are beneath the crane which serves the casting machines. Here they are picked up in pairs turned at right angles as was mentioned in a previous article, and delivered to the rails of the delivery table alongside the casting machine. They are rolled into the casting machine, poured and taken out in the manner previously described. Then the same crane takes them in pairs and delivers them to the sand removal station.

A simple system for making the bell cores has been developed. The machines for making these cores are located on a balcony just back of the molding machines. This same balcony serves to support the core ovens where these cores are dried. A mixture of linseed oil and sharp sand, mixed in a muller type machine is used. The core making machine consists essentially of a pillar supporting a rotating drop head. The hinged corebox shown in the accompanying illustration, Fig. 14 closed with one of the plates shown at *A* at the right in position is filled with the required quantity of sand, the head of the machine, shown at *B*, is lowered inside the corebox and by turning a crank the operator rotates this head so that the sand is pressed back into the rings indicated in the corebox, forming the core as shown in the foreground at *C*. Two men supply sufficient cores for the entire battery of casting machines.

### Ream Out the Sand

Removal of the sand from the flasks and the castings from the sand constituted a problem which the inventor of this process of molding, attacked with characteristic energy and determination. An hydraulic plunger pushing the pipe from the spigot end and thrusting the pipe out of the bell end of the flask was suggested. However, a modified form of reamer, operating between the newly made casting and the flask was the rather unusual method adopted by Mr. Moore and his associates.

As the pipe are delivered from the casting machine to either of the two sand removal stations, they still are at red heat. The flasks are placed on rails, rolled back three at a time to tilting tables and the bell ends elevated by an hydraulic operation similar to that actuating the mechanism at the molding station. The three flasks then are aligned with three reamers at each station. These are steel tubes, slightly over 16 feet long, liberally slotted throughout their length, driven at the lower end by motors and terminating at the upper ends in steel screw cutters. These reamers, revolving at a carefully regulated speed are inserted into the ends of the flasks and cut the sand away from around the castings. The sand trickles back or falls into the slotted recesses in the reamers, while the latter advance the length of the pipe finally emerging at the upper ends of the flask.

The reamers then are reversed and withdrawn, the tilting table is lowered and the flasks brought to a level position. Here a pulling rig, having three clamps which engage each of the set of three pipe and exert a pull of about 2000 pounds, drag the pipe out of the flasks. The latter are returned to their respective molding stations by a transfer track behind the cooling oven to re-enter the cycle.

As the pipe are pulled from the flasks, they are deposited upon rail supports running forward to an enclosed oven. They are rolled forward to the entrance to this oven where they are engaged by a slow moving chain conveyor which causes them to travel forward while cooling.

No external heat is provided in the oven, but the pipe are permitted to cool slowly for about 40 minutes. They emerge still hot enough to be dipped in a manner that will be explained later.

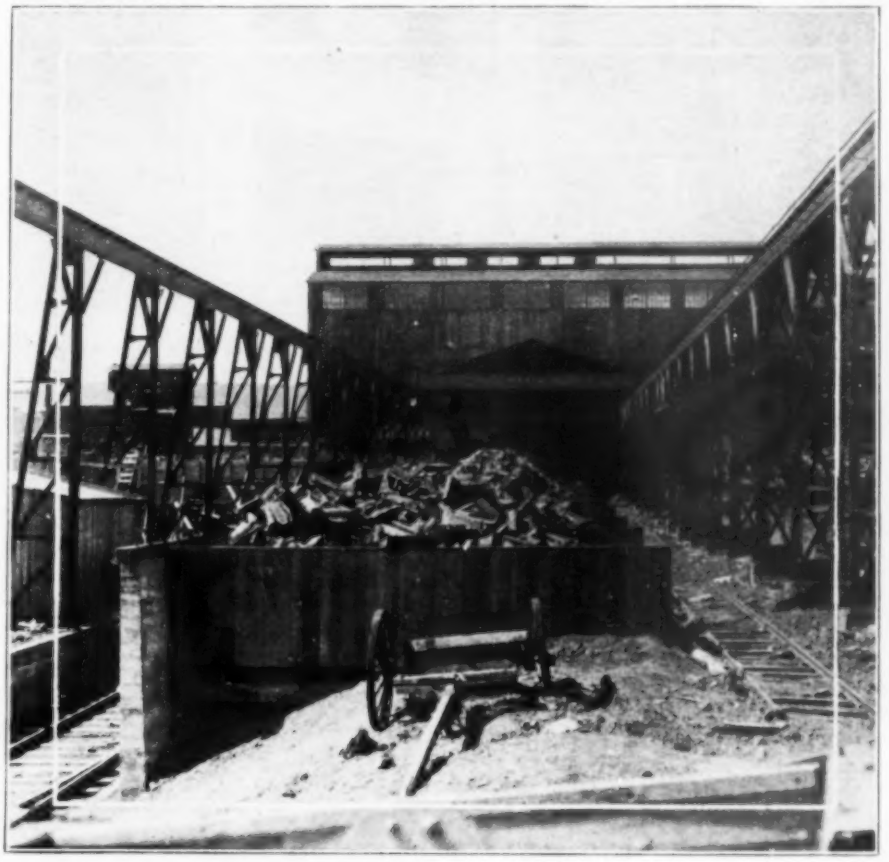


*Fig. 15—General view of the stockyard, showing the incoming railway track, the yard crane carrying a magnet and the track at the right for the storage battery train of transfer cars*

Before leaving the cycle of molding and pouring, it may be best to mention some of the details of time and capacity encountered in the process. The entire cycle from the time a flask is placed at the molding station until it returns, occupies about 60 minutes, according to the management. Eight flasks are provided for each machine, with ample provision for substitution in case of mishap or breakage. The casting machines which furnish the basis upon which the time of all operations is estimated produce castings in a period that varies with the size of the pipe cast. Four and 6-inch pipe are made at an average of about 6 pipe per hour, but it is

*Fig. 16—Placing a tray of scrap on the charging car, preparatory to allowing it to run forward by gravity into the charging door of the cupola at the left*

hoped that an output of 10 pipe per hour will be attained. The 8, 10 and 12-inch sizes require more time had are made at the rate of four or five pipe per hour. In other words, those in charge of operation estimate a spread of from five to a possible maximum of ten 6-inch equivalents per hour. This would give the output of the entire double battery of 12 machine of from one to two pipe per minute.

Molding capacity will take care of the maximum requirement, and the other steps involved are calculated to keep up with the maximum. At present the sand removal operation requires from 3 to 6 minutes. The time required to place, ram and remove the molds permits this step in the operation to be completed so that a supply of molds always is available and a margin provides against any unforeseen delay. Two cupolas of the battery of seven just outside the building housing the centrifugal casting machinery give ample metal to keep the casting machines at top production.

A number of important changes have been made recently in the cupola charging and metal delivery system of the American company. Seven cupolas comprise the melting equipment of the entire plant. Four of these are used to melt metal for the old shop, where vertically sand cast pipe are made. The other three constantly are at the call of the centrifugal shop, although one in continuous operation with two in reserve is the customary practice.

One of the most important changes in the metal department which has been made recently is in the system of charging. All iron is delivered to the plant in its central storage yard. Separate bins are provided, each with a capacity of 3 carloads of iron. Scrap also is separated and graded on receipt. Two traveling cranes of 5-ton capacity each span the yard. These are equipped with lifting magnets by which the metal is picked up and loaded upon charging pans or trays banded with heavy structural steel under straps, terminating in four lugs, two on either side of the tray. The trays have only three sides, the fourth being open, like a scoop. These trays or boxes are fitted and carried on small cars, pulled by a storage battery locomotive until the train of cars is inside of the cupola house, behind the cupolas.

Here a second crane operating back of the cupolas picks them up. Four chains terminating in rings engage the lugs on each tray, lift it aloft to the charging platform where a special charging car and short platform with a track is found back of each cupola.

The charging tray with the material in it is placed on the charging car which is mounted on an inclined track. This incline permits the whole mechanism to roll into the cupola by gravity as the pull on a line attached to the back of the car is released. The back wheels of the car pass through a gravity switch as they approach the forward end of the travel. When the car with its contents is well inside the cupola. Then the car still carrying the charging tray

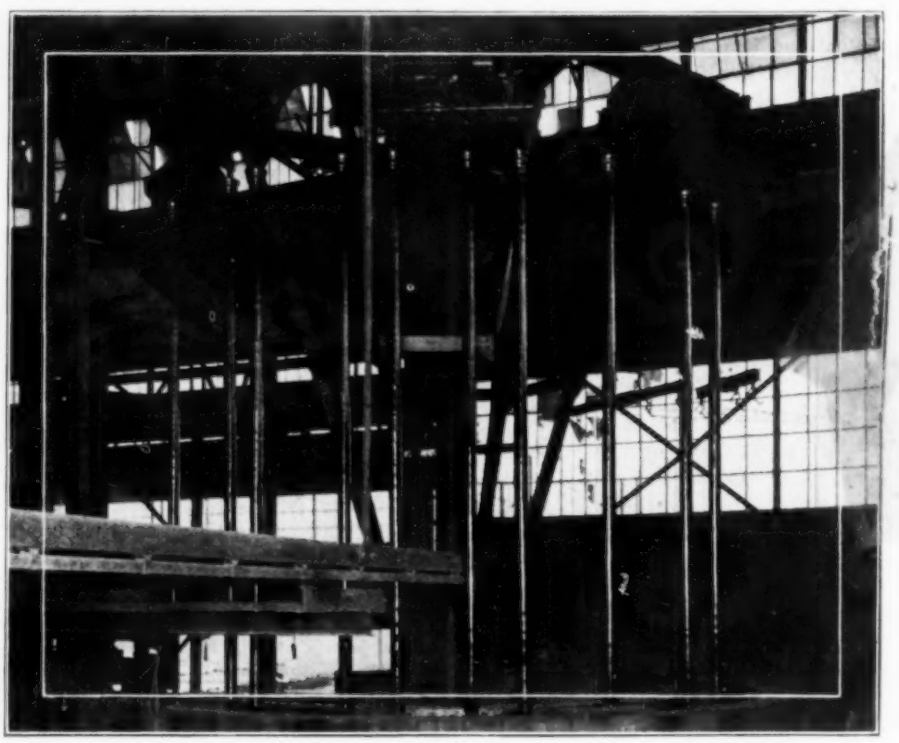


*Fig. 17—One of the two rotating dipping rigs with the pipe drawn from the hot tar bath, dripping and drying as the revolving mechanism carries them around to the right to the point where they are removed for testing*

is pulled back by hydraulic power, operating the pull cable. The back wheels of the car travel upward on two guide rails placed above the rails upon which they ran toward the cupola. This changes the angle of the car and tray, elevating the back end of the tray sharply so that the charge of material under the force of gravity and inertia is spread evenly over the inner area of the cupola. As the charging car, with the box on it, approaches the back end of its path, the wheels follow the upper guide rails back to the original level on the inclined rails first mentioned. The pull of the operating cable holds the car in this position until the charging tray is removed, when the tension is released ready for the next charge. When the tray again is outside, resting on the car, it is lifted and swung back upon its waiting car in the storage battery train.

Coke is charged in a similar manner, although the first charges are forked in as required when going into blast.

The seven duplicate cupolas with 96-inch shells lined to 72 inches, were built in the shops of the American Cast Iron Pipe Co. In the units melting iron for the centrifugal machines, the tuyeres are 24 inches and the bottom of the charging doors are 19 feet 8 inches above the bottom. The cupolas are slagged through the back and as each furnace is separated from its neighbor by a 12-inch concrete wall, the drop is kept separate and readily may be removed without interfering with the adjacent cupola which may be in blast.

Metal is tapped into a 4-ton ladle, carried on a monorail crane of unusual design. About 3 tons of metal is taken at a tap for delivery to the centrifugal machines. A ladle of metal is tapped out in about 2½ minutes and the temperature sought is about 2700 degrees Fahr.

The ladle of metal is carried out of the cupola department by a monorail crane on a line extending along the pouring end of the two batteries of centrifugal machines. Three telphers are available for this work, but only two are in use, one receiving its charge of metal while the other is delivering.

The man in charge of pouring checks the temperature of the metal in the small ladle, adds a small amount of flux and gives the word to the operator of the three machines in the unit of which this particular machine is a part. The correct pouring temperature varies from 2500 degrees for 4-inch pipe to 2400 degrees for the 12-inch size pipe.

The chief chemist maintains rigid control of the metal mixtures and watches the analyses closely. A mixture of all southern pig iron with about 10 per cent steel is charged. The analysis sought for the sand cast, centrifugal pipes approximates the following content: Silicon, 1.50 to 2.00 per cent; manganese, 0.40 to 0.60 per cent; sulphur, 0.06 to 0.075 per cent; phosphorous, 0.70 to 0.90 per cent and total carbon, 3.40 to 3.65 per cent. Occasionally small amounts of ferromanganese or other alloys are added in the ladle as required.

Returning to the finished pipe as it emerges from the cooling oven, the operation is similar to general pipe practice with certain refinements which have been introduced by Mr. Moore. The pipe are delivered upon a table formed of double rails as in previous cases. The inside is ground by passing a small swing grinder entirely through the pipe. This serves to remove the loose slag which intentionally was formed when the pipe was cast. Any burr encountered between the bell core and the inside line of the pipe also is cut away. The pipe then are hooked, four at a time, to cross beams, bell end up and hoisted to a circular turntable at sufficient height above the floor level so that the lower edge of the pipe clears the lower edge of the dipping tank. This dipping tank is formed by double walls of concrete running deep into the basement. The pipe are lowered into a bath of coal tar bought on specification and maintained at a temperature of about 235 degrees Fahr. This temperature is maintained by steam pipes. After being dipped the pipes are elevated clear of the tar and revolved slowly, being allowed to drip the entire circuit of the dipping machine so that when they are removed at the completion of this revolution at the end of about an hour, the tar is dry and hard. The pipe then are tested either by pneumatic or hydraulic pressure as may be required and delivered to a shipment yard outside the plant.

## Holds Annual Convention

Attended by 2212 members and guests, the forty-seventh annual meeting of the American Society of Mechanical Engineers, New York, Dec. 6-10, recorded itself as one of the most successful that the society has held. The registration exceeded the previous record of 2174. Many of the 66 sections of the society and of its 87 student branches were represented. The program was the largest that had been attempted, 72 papers being scheduled for 1926 compared with about 43 in 1925. More divisional meetings were held in 1926, four or five sections holding simultaneous sessions.

Fuels and combustion problems formed one of the main topics on the program. Machine shop practice, industrial education, oil and gas power, management and materials handling were other subjects discussed.

On the president's night, William A. Abbott, retiring head of the society gave his presidential address and Charles M. Schwab, president-elect, was formally introduced. The John Fritz gold medal for engineering achievement was presented to Elmer Ambrose Sperry.

Dr. Cecil Howard Lander, director of fuels research, department of scientific and industrial research, London, Eng., gave the Robert Henry Thurston lecture and Dr. Davis Rich Dewey, department of economics, Massachusetts Institute of Technology, Cambridge, Mass., delivered the Henry Robinson Towne lecture.

## Book Review

*Tentative Standards 1926*, 1100 pages, cloth, 6 x 9 inches, published by the American Society for Testing Materials, Philadelphia, and supplied by THE FOUNDRY, Cleveland, for $8.50, and in London, 2-3 Caxton House, Westminster S. W. 1 for 42/6; in paper $7.50 or 37/6.

This volume contains 227 tentative specifications, methods of test, definitions of terms and recommended practices of the American Society for Testing Materials now in effect. These tentative standards are published for one or more years before formally being adopted by the society as standards. Although still in the trial stage, the tentative standards represent the latest thought of the committees on the subjects covered, and should find important applications in various industries. Listed under the head of ferrous materials are twenty-nine tentative specifications including three tentative methods for testing and one recommended practice dealing with these materials. There are also twenty-seven tentative revisions for standard specifications now adopted. Nonferrous materials are treated under twenty-seven tentative specifications and two tentative methods for testing. Tentative revisions for standards now adopted for nonferrous materials number 14. Other materials dealt with are cement, lime, clay products, preservative coatings, petroleum products and lubricants, road materials, coal and coke, timber, and a number of other materials.

# Shear Test Is Found *Impractical* for Routine Work

By G. K. Elliott

GRAY cast iron rarely is tested by shearing in this country, but a certain type of shearing test for some time has been advocated and practiced as suitable for gray iron castings in France and possibly in other European countries, the Fremont shear testing machine being the apparatus used. The committee on gray iron castings of the American Foundrymen's association, having had the subject of tests under consideration for some time, several years ago asked the association to secure for the committee's research one of these machines. The object was to obtain more light on testing gray iron, a subject which in recent years has caused much vigorous international argument among foundrymen and metallurgists. Upon receipt the machine was sent in turn to three members of the committee for trial and comment, the present paper containing results and experiences gained by the third of these members. A supplementary paragraph contains results secured by one of the other members.

The Fremont machine is a beam-acting, single-shear apparatus which shears short lengths from small cylinders, 5.64 mm. or 0.222 inches in diameter and about one inch long, previously drilled or trepanned from castings by means of a core-drill or hollow milling cutter. Also the machine will accommodate test pieces with a square section of 5 mm. x 5 mm., although none of these is used in the present tests. The round holes left by the drill are about 0.4 inch (10.5 mm.) in diameter, and it is claimed that these can be plugged and the castings used as originally intended after the tests have been made; or else the sample can be taken at some place where a hole would be made during the machining of the casting.

A photograph of the machine is shown in Fig. 1. By the hand-operated worm *A* the poise *B* which in the present machine happened to weigh exactly 94 pounds with all its attachments, is run out on the beam *C* until the blades at *D* shear the test piece *F*. Since the length removed is short, several tests can be made from each piece. Attached to the poise-carrier at *E* is a pencil which traces a slightly downward dipping horizontal line as the poise travels out the beam. A number of these autographic lines are shown in Fig. 3. The horizontal length of the lines represents the load, while the dip is partly a reflection of the amount of shearing deformation, the degree depending upon the rigidity and relative position of the blades.

Since no chart sheets accompanied the machine and since the beam bore no calibration markings, we were forced to make use of such cross-section paper as was at hand and to calibrate the machine after carefully determining its constants, which was not an easy task. It was found that the position of the poise on the beam at the beginning of each test is 2.93 inches from the axis, representing an initial stress of 670 pounds on the specimen, equivalent to about 17,500 pounds to the square inch.

## Gives Results

*THIS article is abstracted from a paper prepared by George K. Elliott, who died on Sept. 23, shortly before its presentation at the American Foundrymen's convention held in Detroit. The shearing test suggested by Fremont is used seldom in this country, but seems to be employed a great deal in Europe. Mr. Elliott gives the results that he obtained from specimens tested in a machine of the Fremont type. He also explains the difficulties encountered in obtaining specimens and describes a shearing machine of his own design to eliminate certain objectionable features and to provide single or double shear tests as may be desired*

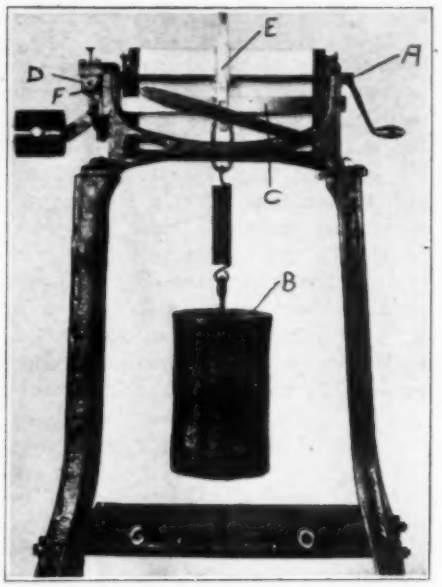



FIG. 1—SINGLE-SHEAR, BEAM-ACTING MACHINE FOR CONDUCTING TESTS

When it came to drilling test cores with the hollow drill which came with the machine, trouble was encountered. As received, this drill had no means of ridding itself of the chips which collected in the hollow, where they exercised on the core being cut, an irregular grinding action which produced pieces elliptical in cross section instead of perfectly round as they should be for accurate results. This was remedied by making openings in the wall of the drill to allow the chips to escape as fast as formed. Reasonably accurate test pieces even then were rather difficult to obtain. The corrected drill is shown in Fig. 1 on the stand directly under the poise of the machine. To its left is another drill lying on its side; on its right are two test pieces ready for test, while at the extreme right and left are pieces of arbitration bars with the test cores drilled but not removed.

In making the test the specimen is held in two round holes of practically the same diameter as the piece, one hole being in each shear blade. It was found advisable to have the fit here fairly close, because specimens much under size so as to lie loosely in the holes tended to throw the moveable shear blade, which in this particular machine was rather free to move horizontally, away from the plane of true shear, introducing thereby a small but potent amount of bending moment. In fact the best results were obtained when the test pieces were exactly 5.64 mm. or 0.222 inches in diameter—a size which fitted snugly in the holes of the shear blades. Since it was practically impossible to make the hollow drill de-

liver pieces with this degree of accuracy, in all the tests reported in the present paper the writer resorted to the practice of first cutting the specimens with a slightly over-size drill and finishing them to exact size on a small precision lathe. This was arduous and time consuming but for even fair accuracy seemed necessary. Our main criticism of the test in fact is the great trouble necessary to obtain reliable test pieces which are perfectly round in section and of the specified diameter. Something more than a mere hollow drill for preparing the sample seems necessary as well as some apparatus for shearing which is constructed more rigidly and carefully than the one at our disposal.

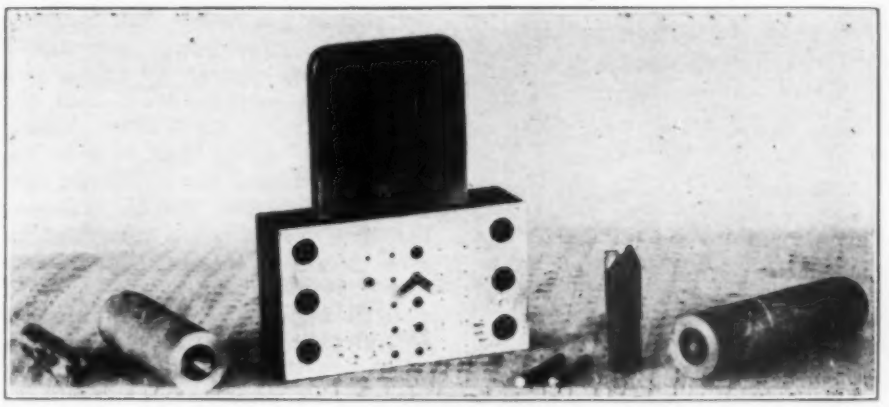
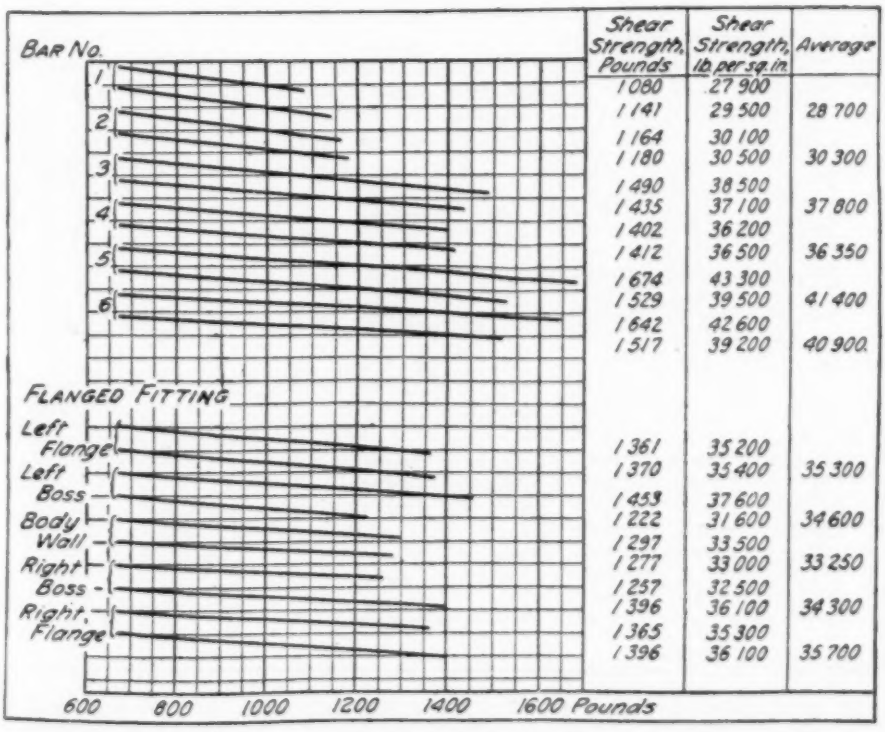


FIG. 3—SINGLE OR DOUBLE SHEAR TESTING DEVICE FOR VARIOUS SIZED BARS. HOLLOW DRILLS AND BARS ARE SHOWN BESIDE THE MACHINE

### How Tests Were Conducted

Shearing tests recorded here were made with the object of discovering their relation to the results of other kinds of mechanical tests on identical iron castings. For this, good subjects seemed to be arbitration test bars as described in American Society for Testing Materials standard specifications *A* 48-18. First the bars were given the customary transverse test between 12-inch centers. One of the resulting pieces was sufficient for both the tensile and the shearing tests, the sample for the shearing test being drilled longitudinally from the center of the fracture of the transverse test. The other piece from the transverse test was used for the scleroscope, brinell and rockwell hardness tests and for the drop test. All the hardness tests were made about ⅛-inch beneath the original surface of the bars and therefore represent somewhat stronger iron than the shearing tests made in the center of the cast bars. For the drop tests the piece was laid upon supports six inches apart and a 20-pound tup dropped on its middle from successive heights of six, seven, eight, nine, ten, etc., inches until fracture occurred, the total number of inch-pounds being recorded. At the end there were at hand from the same original bars, data from transverse tests, tensile tests, hardness tests of three kinds, and drop tests, to be compared with shearing test data.

In addition a 6-inch flanged pipe fitting made from the same ladle of iron as one of the bars, was sampled in several places and shearing tests made, which gave a comparison between the shearing strength of an iron in a commercial casting and in an arbitration test bar; also there was afforded a comparison of the shearing values of the iron in several parts of a single casting.




| Shear Strength, Pounds | Shear Strength, lb. per sq. in. | Average |
|---|---|---|
| 1080 | 27 900 | |
| 1141 | 29 500 | 28 700 |
| 1164 | 30 100 | |
| 1180 | 30 500 | 30 300 |
| 1490 | 38 500 | |
| 1435 | 37 100 | 37 800 |
| 1402 | 36 200 | |
| 1412 | 36 500 | 36 350 |
| 1674 | 43 300 | |
| 1529 | 39 500 | 41 400 |
| 1642 | 42 600 | |
| 1517 | 39 200 | 40 900 |
| 1361 | 35 200 | |
| 1370 | 35 400 | 35 300 |
| 1453 | 37 600 | |
| 1222 | 31 600 | 34 600 |
| 1297 | 33 500 | |
| 1277 | 33 000 | 33 250 |
| 1257 | 32 500 | |
| 1396 | 36 100 | 34 300 |
| 1365 | 35 300 | |
| 1396 | 36 100 | 35 700 |

FIG. 2—CHART GIVES AN AUTOMATIC, GRAPHIC RECORD AS THE TEST IS CARRIED ON

### Discussion of Data

Fig. 2 shows the characteristic graphs automatically recorded by the Fremont apparatus for each of the pieces tested and the values obtained. Each shearing was made twice on the same piece and the results averaged. The accompanying table gives the chemical analyses of the pieces and results of the several mechanical tests.

Chemical analyses reveal three grades of iron in the arbitration bars. Bars 1 and 2 have the highest total carbon and silicon; bars 3 and 4 the same carbon as bars 1 and 2 but lower silicon; and bars 5 and 6 have both carbon and silicon lower. Naturally the irons are stronger progressively in the order given. The values for the Fremont shearing test parallel those for the transverse, tensile, hardness and drop tests in an orderly manner indicating it to be a reliable index of the general strength of the iron. Of course under less favorable conditions in which the shearing sample might be taken from a weak spot of a more intricate casting than those used in the present tests, the preceding statement manifestly would not be true, nor could such sample be considered representative of the general quality of the iron in the casting itself.

Shearing values of cores drilled from various locations on the 6-inch flanged pipe fitting are especially noteworthy because the casting was made from the same iron as bar 4. A study of the results enables us to judge the relative strength of a given iron when cast in standard arbitration test bars and in a cored, cyl-

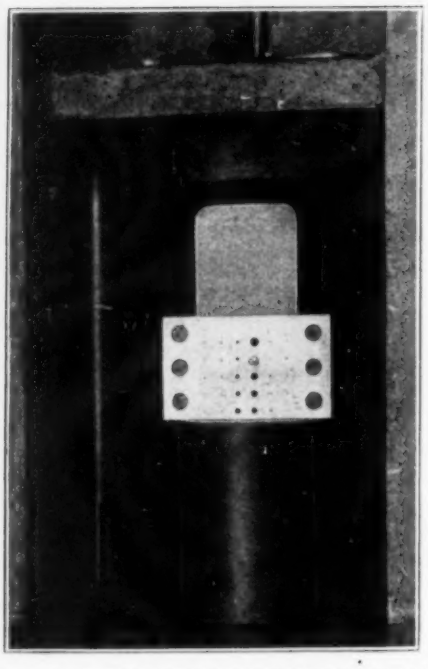


FIG. 4—SHEAR TESTING DEVICE USED IN CONNECTION WITH A UNIVERSAL TESTING MACHINE

indrical casting weighing about one hundred pounds with metal thickness varying from about ¾-inch in the main body wall to twice that in the end flanges. We find that the average shearing strength of the small test pieces drilled from the heart of the arbitration bar is 36,350 pounds per square inch, while in the flanged casting it is only slightly lower, being 35,300 and 35,700 pounds in the two flanges, 34,600 and 34,300 pounds in two bosses located about one third the distance from each flange, and 33,250 pounds in the body wall midway between the flanges. The maximum difference is between the bar and the body wall and is only 3100 pounds, equivalent to 8½ per cent. However, in no case is the strength of a sample from the cast fitting equal to that of the test bar. Also it is interesting to note that there is little difference between the various parts of the casting which were sampled for the test.

It will be noted that the specimens drilled from the heavy bosses of the flanged castings show a rather wide difference in shearing strength. This is accounted for by the fact that the specimens were sheared so as to represent the iron at two different depths from the casting's surface. This condition did not exist in the samples from the other less thick parts of the casting which explains the closer agreement in the tests of those parts. Two additional tests on one piece drilled from a boss which were made so as to represent the iron near the surface of the casting and at the center of the thickest part, gave 38,300 pounds per square inch shearing strength at the outside and 31,600 pounds at the center. Of course this is explained on the grounds that the iron near the outer surface having cooled more rapidly than that in the interior, will have more combined carbon and therefore will be stronger. For true comparisons therefore, in cases like the one just cited, tests should be made either at a specified distance from the outer end or else at several fixed intervals along the specimen and the results averaged. In the shearing tests made on specimens from arbitration bars the strength does not vary because the pieces all were taken longitudinally from the center of the bars where the cooling rate was the same throughout their length.

### Test Apparatus Is Modified

Since the Fremont shear apparatus is not available in this country it occurred to us that the same test could be made with apparatus which is simpler, cheaper and more within reach of the average foundry. Accordingly there was made a device for either single or double shear which is shown in Fig. 3. Mounted on the platform of a standard universal testing machine it is illustrated in Fig. 4. It consists of two ½-inch steel plates spaced ½-inch apart with a close fitting plunger shear blade free to move between. In the shear blades are several holes of various diameters to accommodate slight variations in the size of test pieces, relieving the necessity of adhering so rigidly to an exact diameter and so hastening production of the pieces. The apparatus also was built so that the shear blades cannot deviate from the plane of true shear and so introduce slight bending moments into the tests, which was a point at which the Fremont machine was slightly at fault.

The overall dimensions of this shearing device are 1½ x 3 x 5 inches. It has to be supplemented with some form of testing machine which can apply and weigh loads which seldom, if ever, will run as high as 2000 pounds for single shear tests which is equivalent to about 52,000 pounds per square inch for a 0.222-inch diameter bar. For double shear the loads will be twice as great. Either single or double shearing tests can be made with the apparatus although the usual length of specimen allows only one double shearing. The Fremont machine is fitted only for single shearing.

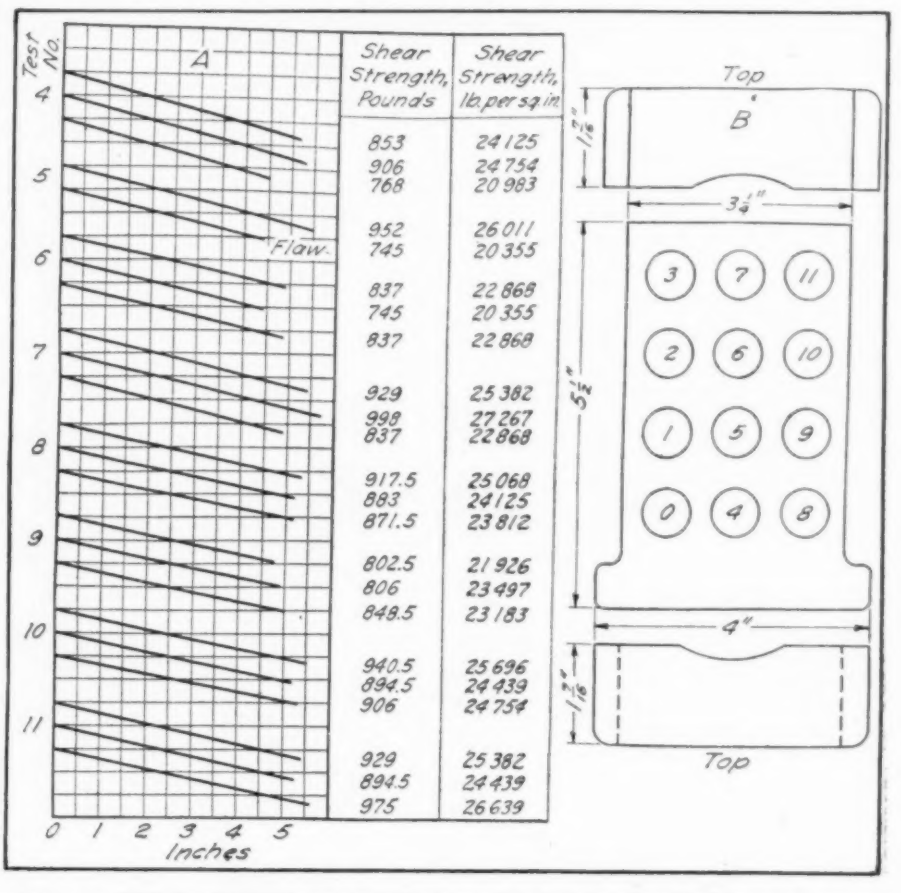



FIG. 5—*A*—CHART SHOWING THE DISTANCE THE SHEARING WEIGHT HAD TRAVELLED AT TIME OF SHEAR. *B*—SKETCH OF CASTING TESTED SHOWING THE LOCATION OF THE TEST SPECIMENS. CHEMICAL ANALYSIS: TOTAL CARBON, 3.20; COMBINED CARBON, 0.60; GRAPHITIC CARBON, 2.60; SILICON, 2.00; MANGANESE, 0.62; PHOSPHORUS, 0.78; SULPHUR, 0.09 PER CENT

It was noticed that where duplicate tests were made with the two machines the Fremont consistently gave slightly lower results than the other, which probably was due to the new apparatus offering conditions more favorable to pure shearing.

On account of the deficiencies found in the machine used in his investigation, the writer's judgment is not entirely favorable to the Fremont shearing test as a routine test to replace the transverse so commonly used in this country, but on the other hand he is disposed kindly to it as a means to a much needed line of research. The care and time necessary to secure reliable samples seem to militate against it for routine testing, and there is a question in the minds of some persons whether results obtained from so small portions of a relatively large casting are as indicative of the quality of either the iron or the casting as are separately cast test bars made from the same metal as the casting. Unless the small shear specimens are selected intelligently from the casting they may be misleading; in fact, in matters of specification and contract it would seem that the location to be drilled for samples would have to be stated definitely.

However, there is an important field in which the shearing test of small specimens taken from castings, should be of great practical value. This is in making thorough explorations of castings for the purpose of locating their point of weaknesses. Data thus obtained should be of more than passing interest to designing engineers who are not always happy in their layout of foundry patterns. Foundrymen also would benefit because points of structural weakness frequently are centers of molding troubles. We can see a splendid future for this type of research and as a means to its accomplishment the shearing test described may invite careful attention.

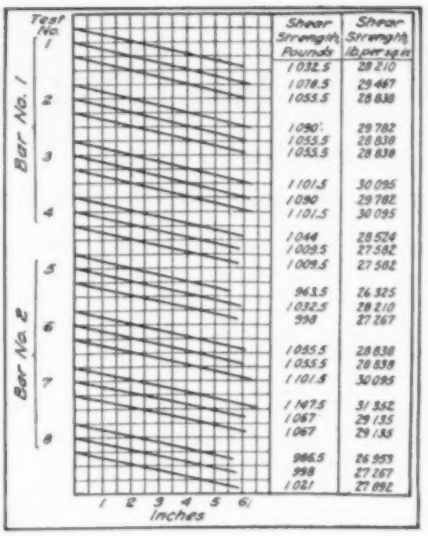



FIG. 6—GRAPHIC PRESENTATION OF SHEARING TEST DATA

Data by W. H. Rother: Chart showing the distance the shearing weight had travelled at the time of shear-transverse test, Bar 1, load in pounds, 3020; deflection, 0.13 inches; Bar 2, load in pounds, 3150; deflection, 0.11 inches. Chemical analysis: Total carbon, 3.30; combined carbon, 0.60; graphitic carbon, 2.70; silicon, 1.75; sulphur, 0.085; phosphorus, 0.385; manganese, 0.65 per cent.

In concluding the paper we take pleasure in showing some results obtained with the Fremont machine by W. H. Rother, Buffalo Foundry & Machine Co., Buffalo, who also is a member of the committee. Fig. 6 shows the result he secured from specimens drilled from a solid casting which, according to the original chart, was approximately 1⅜ by 3¼ by 5¼ inches in dimension. The results fail to indicate any great difference in shearing strength in the various parts of the casting, although Nos. 7 and 11, which probably received the most rapid cooling, are slightly stronger than the others.

## Chemical and Physical Characteristics

BARS

| | Bar 1 | Bar 2 | Bar 3 | Bar 4 | Bar 5 | Bar 6 |
|---|---|---|---|---|---|---|
| Total carbon | 3.50 | 3.51 | 3.40 | 3.46 | 3.16 | 3.22 |
| Silicon | 2.00 | 1.96 | 1.60 | 1.69 | 1.50 | 1.50 |
| Manganese | 0.57 | 0.55 | 0.61 | 0.66 | 0.56 | 0.61 |
| Phosphorus | 0.51 | 0.56 | 0.42 | 0.45 | 0.35 | 0.36 |
| Sulphur | 0.081 | 0.073 | 0.077 | 0.072 | 0.063 | 0.070 |
| Shear, pounds per square inch | 28,700 | 30,300 | 37,800 | 36,350 | 41,400 | 40,900 |
| Tensile, pounds per square inch | 21,900 | 23,700 | 28,500 | 27,700 | 36,700 | 35,900 |
| Transverse strength, pounds | 2,700 | 2,875 | 3,575 | 3,510 | 4,100 | 4,040 |
| Deflection in 12 inches | 0.14 | 0.13 | 0.157 | 0.162 | 0.154 | 0.150 |
| Drop test, pounds | 420 | 600 | 1,020 | 1,020 | 1,260 | 1,260 |
| Scleroscope hardness | 38 | 40 | 40 | 40 | 42 | 42 |
| Brinell hardness | 179 | 196 | 196 | 196 | 217 | 217 |
| Rockwell hardness | B-90 | B-93 | B-94 | B-93 | B-98 | B-97 |

FLANGED PIPE FITTING

| | Left flange | Left boss | Body wall | Right boss | Right flange |
|---|---|---|---|---|---|
| Total carbon | ..... | ..... | 3.45 | ..... | ..... |
| Silicon | ..... | ..... | 1.72 | ..... | ..... |
| Manganese | ..... | ..... | 0.66 | ..... | ..... |
| Phosphorus | ..... | ..... | 0.42 | ..... | ..... |
| Sulphur | ..... | ..... | 0.065 | ..... | ..... |
| Shear, pounds per square inch | 35,300 | 34,600 | 33,250 | 34,300 | 35,700 |

## Refractory Sand Needed for Steel Molds

*Question:* We use a mixture of fire and Albany sand in making the molds for our monel metal castings. We are contemplating the manufacture of nickel-chrome-steel castings and we are wondering if the same sand would serve satisfactorily. If not we shall appreciate your advice on the proper class of sand to employ.

*Answer:* Ordinary molding sand either alone or mixed with sharp sand does not make satisfactory molds for steel castings. The only material fit to be used for this purpose is a high grade silica sand, bonded with a minimum amount of clay. You may be interested to know that when the steel casting industry was in its infancy the writer tried practically every refractory material available in a large iron foundry in attempts to find a suitable facing for low carbon steel castings. Facing sand mixtures that imparted a perfectly clean and smooth face to an iron casting weighing 100 tons, imparted a dirty, pock marked face to steel valve castings weighing less than 50 pounds. Also the castings leaked.

Facing sand for steel castings must be highly refractory and in addition must be exceedingly permeable to gas. A wide variation may exist in the relative proportions of the component parts, but all are based on silica sand and fire clay. A naturally bonded sand is used extensively in the East, but in other localities the mixture is prepared in a mechanical mixer. Any open grade of sand will serve for a backing, but naturally in the course of time it becomes strongly impregnated with silica sand from the facing. A typical facing is mixed in the proportion of 10 parts sand to 1 part clay moistened with molasses water and thoroughly mixed in a muller type mixing machine. Old sand is introduced into the mixture at the discretion of the foundryman. Molds that are to be dried are painted with a wash made up of silica flour and molasses water. It is applied like blacking to molds for iron.

In starting to handle steel castings of any kind either plain carbon or alloy, it is advisable to dry the molds thoroughly and pour them while still warm. Gradual experience will suggest changes in facing mixtures, in gates and heads, in methods of handling the metal. Eventually you may be able to make many of the castings in green sand molds and thus effect economies, but in the beginning it will pay to go slowly.

# How and Why in Brass Founding

By Charles Vickers

## Gas Holes Spoil Castings

*We have trouble making castings of phosphor bronze containing high phosphorus, and we think the large amount of phosphorus is the cause thereof, as we have no difficulty when casting the same alloy with lower phosphorus. However we are unable to change the specifications. The alloy causing trouble is: Copper, 89 per cent; tin 9 per cent and phosphor-copper 5 per cent and the similar alloy that causes no trouble consists of copper, 89 per cent, tin 9 per cent and phosphor-copper 2 per cent. The high phosphorus alloy gives castings filled with gas holes which look all right before machining. We have poured both hot and cold with the same result and have tried everything we can think of to remedy the gas holes but without result. We would like to get a binder for graphite plumbago to make a mold of this material and dry it in the core oven. We have tried flour and molasses water, but the plumbago crumbles to powder for lack of body.*

It is more difficult to cast alloys containing a large amount of phosphorus than the alloys that are simply deoxidized with this element, but it can be done. The alloy contains approximately 0.73 per cent phosphorus, which is not excessive for a regular phosphor bronze in which the phosphorus is used for its hardening qualities. When making the bronze use no fluxes on the metal, simply use charcoal in coke-fired, crucible furnaces and add, with the copper, a few pounds of scrap metal of the same composition which will carry phosphorus enough to act in a deoxidizing capacity to the copper, then add the tin and the phosphor-copper. When using as much as 4.85 per cent of the latter, it is well to know the analysis to be sure that is is an alloy of phosphorus and copper and not an admixture of phosphorus and all sorts of junk metal. When a few ounces only of phosphor-copper is added per hundred pounds of metal as a deoxidizer the impurities may do no harm, but this does not obtain when the alloy or admixture is used in quantity, for while phosphorus is known as a *deoxidizer* in the presence of certain bodies it easily forms gaseous products which aerate the metal and continue to do so after solidification. We do not advocate the use of yellow stick phosphorus at the present time, as the art of using it properly largely died with those who were compelled to use it, but it may be remarked that little spongy phosphor bronze was seen in those old days.

Ram up the molds in a dry sand mixture, using an open sand, and paint them well with a good grade of plumbago wash dry overnight, and clean castings will result. Coat the cores with plumbago rubbed on with the fingers. Use nothing but plumbago, as silica wash has been known to produce aerated castings. It is not advisable to attempt to make molds entirely of plumbago, as it is too close, and gases cannot escape, but if it is desired to attempt this there is no better binder than a solution of silicate of soda, although we advise experimenting with the first to determine whether it produces any gas that is soluble in the metal. When the phosphorus is low, such a binder gives excellent results. Flour or dextrin should be used as a binder for a dry sand mold.

## Casting Brass Ferrules

*We have just gone into the brass-foundry business in a small way and we would like to obtain the formula of the alloy used in making brass ferrules, the most popular method of gating such castings.*

Usually a yellow brass high in zinc is cast into ferrules, not because it has any particular qualities that make it better for such purpose, but because it is cheap. The following alloy is an illustration; copper 56 per cent; zinc 40 per cent; lead 4 per cent. As a deoxidizer and fluidizer a little aluminum is added; from 2 to 4 ounces per hundred pounds of alloy. Just enough should be added to promote sufficient fluidity to enable the alloy to flow perfect castings.

The larger sizes of ferrules frequently are cast vertically with a green sand core and gated at three points on top of the bead. With a sprue on top of the core, the latter might be the hub and the three gates the radiating spokes. Smaller ferrules may have to be made with a dry sand core, depending on their shape and size. The margin of profit is small in the case of such castings.

## Requests Size of Bell

*We expect to cast a bell that must be heard ten miles, and would like to know how large it should be to carry that distance?*

Bell size does not govern the distance at which it can be heard; a comparatively small bell having a shrill tone will be heard much farther than a large bell of deep tone, and it is not uncommon for a bell weighing, say, 300 pounds to be heard a distance of four miles. One noted bell of England is *Great Tom O Lincoln* weighing over 6 short tons. This bell on quiet summer evenings can be heard a distance of 4 miles, but this only when weather conditions are ideal for carrying sound. Thus this large bell is no better than a small one when measured by the distance it can be heard, but when measured by richness and quality of tone the superiority of the great bell is overwhelming, and that is why we have great bells. This brings up the question, what is expected of this bell? If it is expected to have a deep musical tone and also carry ten miles, the bell will have to be very large; thus the old New York City hall bell weighing 11 tons could be heard when conditions were favorable a distance of 13 miles up the Hudson river, but the water, of course helped to carry the tone, over land it would be doing well to carry ten miles.

It is not possible to suggest the weight of such a bell that will enable the tone to carry ten miles. In general it may be said to make it as large as the money to be spent will permit. In making the bell it is advisable to use a copper-tin alloy with from 20 to 23 per cent of tin, and if it is necessary to deoxidize the alloy, use iron added in the form of a flux of yellow prussiate of potash or soda, with a little silica sand and perhaps soda ash. When the bell is hung it must not be enclosed in a box-like structure, as this shuts in the sound. We further suggest that no matter how large it is decided to make the bell, that no guarantees be given in regard to how far it will be heard, as this will entirely depend on where it is located, the absence of other noises, and atmospheric conditions over which the maker of the bell will have no control.

*Reviews American*

# Steel Foundry Industry

## Specifications Should Not Contain Too Many Limits—Field for Future Research Is Wide

PART II

By R. A. Bull

THIRTY years ago a scientifically trained major in the Italian army chose a location in the Alps for exhaustive experiments to demonstrate his faith in the theories held for many years by eminent scientists, that the electric current could be made a satisfactory source of heat for melting and refining steel. Major Stassano's success in 1899 immediately drew the attention of other experimenters in Europe to this method of making steel. Progress in developing the electric steel furnace was pronounced for several years in France, Italy, Germany, Norway, and Sweden. English steelmakers did not find themselves in a particiularly advantageous position with respect to this development because of the topography of their country and the resulting scarcity of waterpower.

Almost ten years after the electric furnace was demonstrated by Stassano to be a successful method of steel manufacture commercially, metallurgists began their first experiments with it in America. The United States Steel Corp. had prior to this sent its investigators, to Europe to study the operation of electric furnaces, of both the arc and induction types.

Pioneers in making electric steel in this country, mentioned in consecutive order, were the Halcomb Steel Co. the Firth-Sterling Steel Co., the General Electric Co., and the United States Steel Corp. The first two of these started to make electric steel commercially in 1908. Not long after the announcement of the regular production of electric steel for the fabrication of parts not made in the foundry, certain steel founders who specialized in small work began to study the adaptability of the new unit to their plant operations.

High installation cost was a factor that made steel foundrymen proceed slowly. An important element of expense in numerous localities then, as in some localities now, was the difficulty of obtaining sufficient electric power at a reasonably low rate. The first steel casting plant selling its product to other industries, which installed an electric steel furnace, was the Lebanon Steel Foundry, where the regular production of electric steel castings for miscellaneous purposes began in 1912.

As previously explained, there was about this time (1910) a quickened demand for small steel castings. This had increased materially the combined capacity of steel casting plants employing converters. Within three years the output of castings from converters. had leaped from a little more than 20,000 to nearly 60,000 gross tons.

**Developments in electric furnace steel castings, alloy steel castings and the results of cooperation in the industry are discussed in this article, which is the second section of a paper presented at the Detroit convention of the American Foundrymen's association.**

Meanwhile, some of the steel companies that had installed the electric furnace primarily for rolled or forged products, largely for their own use, began to make a few steel castings. In the year 1908, 55 tons of castings were produced in this way in this country, and during the following year, approximately 300 tons. By 1912 the output of electric steel castings had grown to more than 4000 tons, and in 1913 it had reached the figure of 9200 tons, then amounting to slightly less than 1 per cent of the output of all steel castings produced in the United States.

Undoubtedly the capacity of the electric branch of the steel foundry industry, during a few years, starting with 1910, was increased greatly by the lively imagination of certain exploiters of the new melting medium, who unwisely but successfully undertook to sell many foundrymen with the idea that the electric furnace is admirably adapted to the manufacture of any kind of steel casting within the weight limit regulated by hearth capacity.

Some of these enthusiasts vigorously proclaimed what they might have thought, but what was not, and is not, true, viz., that electric furnaces can produce steel satisfactorily with less attention than is required for the operation of converters or open-hearth furnaces. Apparently a few foundrymen have adhered to these mistaken ideas. A producer of steel castings, at the 1925 convention of the American Foundrymen's association, stated that less skill is needed for operating the electric steel furnace as compared with the open-hearth or converter.

Inquiry should be made regarding the uniformity, ductility, and other characteristics of steel produced, before acceptance of claims that within a few weeks a reasonably intelligent man who never previously made steel can be graduated as a good electric steel melter. It should be kept in mind that there are good, bad, and indifferent grades of metal produced from every kind of steel furnace in use; and that no process is foolproof, nor capable of satisfactorily functioning according to high standards, without skilled manipulation.

Increasing manufacture of rolls during the late nineties led to experiments with alloys, which resulted in the development of important combinations of the elements for that special purpose. Discovery of manganese steel by Sir Robert Hadfield in England in 1888 was followed, four years later, by the manufacture of the first manganese steel castings in the United States at the plant now owned by the Taylor-Wharton Iron & Steel Co., High Bridge, N. J. This development perhaps was the most important one related to alloy steels that characterized steel foundry operations during the nineteenth century in this country. The manufacture of manganese steel became a specialized branch of the industry and the product was found to have superior properties for a number of uses to which carbon steel was poorly adapted.

Manganese steel has been made in crucible furnaces, converters, open-hearth furnaces and electric furnaces. The preferred method at present employs the electric furnace.

Study of the performance of steel containing from 13 per cent to 15 per cent managanese, commonly

classed as manganese steel, developed the fact that this material was not suited best to some purposes for which carbon steel had been employed unsatisfactorily. This prompted experiments with varying percentages of manganese above the content used ordinarily in the steel foundry but below the amount in what had been called manganese steel. The result was the development, due mostly to John Howe Hall, of a useful group of simple alloys, highly susceptible to scientific heat treatment. These became favorably known about 1915.

### Organized Co-operation

It is unnecessary to make detailed references to the developments of cast steel containing vanadium, nickel, chromium, molybdenum and certain other elements that have been employed to greater or less extent in making special products in the steel foundry. Origination of many special combinations has been attended by the perfection of special heat treatments, inasmuch as it is realized that the customary single normalizing or annealing operation does not develop many latent valuable properties in alloy steels.

At the present time experiments are being made to produce alloy steels for castings to withstand high temperatures and pressures simultaneously and continuously applied in service. This presents the most difficult problem steel foundrymen have been asked to solve by industry.

We have shown that the American Society for Testing Materials was the first national organization to stimulate the steel founder in improving his shop practices, through the co-operative investigation of testing methods, which began in 1900. The American Foundrymen's association, organized in 1896, failed to draw the serious attention of steel foundrymen as a class to its opportunities for advancing their industry, until about 1911.

Interest manifested at that time in the presentation of papers on steel foundry topics prompted a movement on that part of progressive manufacturers of steel castings to utilize the American Foundrymen's association as the logical medium for the interchange of experiences and for the discussion of theories relating to the technical phases of the industry. Without doubt this association has been the most effective means for developing co-operation between steel founders, through cordial relationships established between operating executives of competing organizations. Approximately 200 steel foundries are at this time affiliated by membership in the American Foundrymen's association.

The invaluable aid to the industry rendered by the association as a technical body has been supplemented helpfully by the Steel Founders' Society of America as a trade organization. It was founded in 1902, at a time when the industry sorely needed a medium for the joint consideration of business problems such as ordinarily engage the attention of trade associations.

Other organizations and institutions whose activities have national significance, which have been helpful in one or more ways to steel foundrymen, include the following: American Institute of Mining and Metallurgical Engineers, American Society of Mechanical Engineers, Society of Automotive Engineers, American Electrochemical society, American Society for Steel Treating, American Welding society, American Iron and Steel institute, National Research council, United States bureau of standards, United States bureau of mines, and the United States division of simplified practice.

In thus giving credit to national organizations and government departments for the assistance they have rendered the steel foundry industry, it is appropriate to mention the benefit derived by American steel founders from the activities of the Iron and Steel institute chartered in Great Britain, but having a membership of international character.

It no longer is necessary to emphasize to steel foundrymen the benefits from co-operation. Probably the future will see numerous collective efforts by competitive manufacturing plants, each such instance of co-operation being intensive, and characterized by a relatively small number of participants employing substantially the same major processes and making similar specialized products. Such smaller organizations reflect specialization in the industry.

### Capacity and Output of The Industry

As a whole, the steel foundry industry without exception of any of its divisions or subdivisions, was vigorously stimulated because of and during the World war. Previous to the war demands that followed the entry of the United States into the conflict, the production of steel castings was sluggish. This is illustrated by the total output of slightly more than a million tons of steel castings in 1913, followed the next year by a production of less than 700,000 tons. During each of the critical wartime years of 1916-1917-1918, the ouput of steel castings in this country remained fairly stable at a figure roughly averaging 1,400,000 gross tons. The peak of wartime production was reached in 1917 when 1,441,000 tons were made. To date the industry's record output exceeds that figure by a very small margin. The maximum demand of 1,458,000 tons was supplied in 1923.

### Excess Capacity

Expansion of the steel foundry industry in America, caused by the war, proved to be uneconomical. Many foundries were built or enlarged. The expectation of obtaining a sound financial foundation for subsequent operations before the declaration of peace, presented such an alluring prospect to some, that they gave inadequate consideration to the varying shrinkages of demand which would immediately follow the cessation of hostilities, which would attend industrial reconstruction, and which would characterize peace-times. Today, the chief handicap of the industry is the enormous combined capacity for producing steel castings, gaged with relation to the developed needs for the product.

Comparative data illustrating the point just made are obtainable from recently published statistics. Within the last few months the American Iron and Steel institute, following the careful accumulation of authentic first-hand information, published the latest edition of its *Iron and Steel Works Directory*. Tabulating the data found in this book, which is the most reliable single source of information on self-estimated steel works capacity available, shows some interesting facts. The yearly capacities of the various branches of the industry, expressed in gross tons of output, as summarized by the writer from the data in this publication are as follows:

| Furnace Type | Tons |
|---|---|
| Acid open hearth | 939,607 |
| Basic open hearth | 909,385 |
| Total open hearth | 1,848,992 |
| Electric | 593,541 |
| Converter | 148,550 |
| Crucible | 2,730 |
| Unclassified | 27,500 |

These figures show a combined annual capacity of the steel casting plants in the United States amounting to 2,622,000 gross tons—an enormous amount much larger than indicated by any previously published statistics.

A comparison of output with capacity is enlightening. The production of gross tons of steel castings in the United States in 1925 is reported by the American Iron and Steel institute in special statistical bulletin

No. 3, published June 12, 1926, to have been as follows:

| Furnace Type | Tons |
|---|---|
| Acid open hearth | 462,303 |
| Basic open hearth | 455,282 |
| Total open hearth | 917,585 |
| Electric | 279,585 |
| Converter | 53,834 |
| Crucible | 1,833 |
| Total | 1,252,786 |

When the figures listed above are reduced to percentages they become especially significant. It is found that the proportion of output to capacity of each classified branch of the industry in 1925 was as follows:

| Furnace Type | Per cent |
|---|---|
| Acid open hearth | 49 |
| Basic open hearth | 50 |
| Total open hearth | 49 |
| Electric | 47 |
| Crucible | 49 |

It is further found that the capacity of each branch of the industry calculated with relation to the combined capacity is as follows:

| Furnace Type | Per cent |
|---|---|
| Acid open hearth | 36 |
| Basic open hearth | 35 |
| Total open hearth | 71 |
| Electric | 23 |
| Converter | 5.7 |
| Crucible | .14 |
| Converter | 36 |

Percentages of the above correspond closely with those indicating the relative production in each of the three major divisions of the industry, as reported for 1925. Open-hearth castings, which in 1910 represented 90 per cent of the entire output of the United States, last year amounted to 73 per cent. Electric castings in 1925 amounted to 22 per cent of the combined production of the industry, having doubled in percentage in 7 years. Converter castings in 1925 represented a trifle more than 4 per cent of the total output, having fallen more than 11 per cent in eight years.

The industry under discussion has a capacity of more than 2,600,000 gross tons per year, and it produced in 1925 1,253,00 tons, or 48 per cent of capacity. The largest output of steel castings in the United States of which there is a satisfactory record, was 1,458,000 tons in 1923, when wartime records were exceeded to slight extent.

These statistics present the most conclusive proof of over-development, and should cause careful consideration by those who contemplate plant erection or addition. This means an analysis of the extent to which each branch of the industry could supply its proportionate share of the total tonnage of steel castings used now and capable of being used economically in the future.

Unfortunately for some investors, steel foundries are not adaptable to other industrial purposes. Equipment for the making of steel castings, particularly those produced from metal made in open-hearth and electric furnaces, entails a large expenditure, and is difficult to remove to other localities. An electric or open-hearth steel casting plant maintains its industrial value only so long as it remains in its original location, and there supplies a fairly steady demand, which is generally a composite expression of the need for the product in a restricted territory. This may be comprehended if it is remembered that according to statistics reported by THE FOUNDRY, in its issue for Aug. 7$, 1926, there are operating today, 357 steel foundries. Of these, 182 are said to be making electric steel.

### Adaptation of Plant to Product

War period and the following reconstruction days taught industry many useful things. The steel foundry operator probably learned more in the five years ending in 1922 than he ever had learned before regarding the kinds of work that could be produced economically in his shop. His information along this line has been increased materially during the past four years by the careful assembly and broad distribution of data relating to costs.

Problem of determining at a reasonable expense and with desirable promptness, the actual cost of miscellaneous steel castings is one beyond the ability of the specialty shop operator to appreciate. The jobbing steel foundry has the disadvantage of a labor cost that is higher ordinarily than all other items of expense. Certain operations cover an enormously wide cost range. Prominent among these is the comprehensive treatment described generally as cleaning, in which the ratio between lowest and highest costs in a steel foundry making miscellaneous castings may be as one to twenty, without any corresponding difference in the production expense of any other department.

Ignorance regarding classified and job costs doubtless is responsible for many serious handicaps imposed on themselves by steel foundrymen in seeking work. Many who, in recent years have studied carefully this phase of the business agree that the industry now is in a healthier condition than ever before, because of the growing realization by steel foundry owners that specific job costs present the only basis for the intelligent search for new business. Such costs are not easy to obtain. Ingeniously devised systems must be tried out carefully for an extended period before they can be regarded as satisfactory for prolonged universal application.

Analysis of job costs has resulted in important changes in manufacturing and merchandising policies in many plants. Conviction grows that the success of the industry as a whole will be dependent largely on the degree to which it becomes further specialized. This term is a rather difficult one for some to apply to jobbing shops. There, however, it is found that many factors other than weight limits may be established, making it feasible to eliminate work poorly suited to existing facilities, and to increase the volume of castings whose manufacture is adapted well to equipment and training locally characteristic.

Probably one of the most important developments in future specialization in the steel foundry industry, because of the amount of work effected, will be the exclusive manufacture in plants having melting units of small capacity, of castings well within the desirable weight limits for shops where special facilities are provided for small and medium-sized work; and the refusal of the larger open-hearth foundries to complicate their operations by the manufacture of castings under those weight and section limits that necessitate extra supervision at the expense of regular work, and temporary expedients because of the lack of special equipment.

Inevitably, as steel foundries are able to install satisfactory systems correctly allocating the many items collectively known as overhead expense, manufacturers of the product will find themselves specializing, sometimes perhaps without fully realizing it, through intensive merchandising efforts to secure work for which specially trained personnel and carefully selected equipment are available. Probably the exasperating complexity of steel casting manufacture has been magnified by the immaturity of the industry, and the resulting lack of specialized effort.

Eventually, all makers and users of the product will know how to classify the steel foundryman who claims to make satisfactorily for the discriminating consumer and profitably for himself, any kind of steel casting in a plant whose principle items of equipment for the major operations are not diversified and separately grouped.

Nature of competition that may be expected affords a topic for discussion in an attempt to gage future conditions in the industry. The problem of competition has differing as-

pects for the several branches of the industry and for producers in each branch, according to the nature of the work being executed in individual plants.

Without attempting to make specific references in parts or devices now being produced in cast steel, forged steel, or malleable iron, some important principles underlying the economic selection of each of these materials may advantageously be considered. The three metals just enumerated are referred to because steel foundrymen generally will concede that their present and prospective efforts to maintain or extend the use of their product bear a closer relationship to the developed or expected adapatation of forged steel and malleable iron than to other materials.

The honest, farsighted, ultimately successful maker of any product does not commit the error of attempting to deceive the user regarding the ultimate economical application of the material submitted as one of several possible to employ. There is no justification for unscrupulous or unintelligent effort to exploit the use of cast steel, forged steel, or malleable iron for any specific application. Each of these materials has its preferred field, in which either of the other products eventually would be disadvantageously utilized, for one or more of several reasons.

No honest, well-informed steel foundryman will deny that properly made steel is slightly improved by skilful hot-working, if the design of the piece is such as to prevent strains from being set up in members to be subjected to service-stresses out of proportion to the resistance of the over-strained sections. No forging expert should deny that a steel object may be seriously injured by forging at improper temperatures or by peculiarities of design that cause excessive strain in locations not adaptable to the forging operation at temperatures within a working range that is suitable, practically and technically.

Properly made steel forgings of certain designs undoubtedly are superior to steel castings, in some physical properties, assuming for the metal in each case equally skilful melting and pouring. It is appropriate to refer to the fact that necessarily, steel for castings generally is delivered from the furnace in a more thoroughly degasified condition than is steel poured in ingots to be subsequently forged; and through that operation to have any gas cavities flattened and apparently eliminated, often not visibly affecting the soundness of the forged article, but actually establishing a potential cause for failure.

These comments are made with no desire to criticize the qualities of the average steel forging, or to deny the economic employment of forgings as compared with castings for certain purposes. The number of pieces required from a single design and the comparative costs of pattern and die equipment are factors of prime importance in choosing the product of the foundry or forging shop, in most cases. But there are other considerations such as have been suggested above which should be kept in mind by the user. He who employs either a casting or a forging should not delude himself by the impression that the properties acertained from a tensile test piece necessarily are indicative of those in each member of any fininshed steel part, especially one of the complicated design.

## Discuss Contraction of Alloy Castings

The joint meeting of the London branches of the Institute of British Foundrymen and the Institute of Metals held at the Engineers' club, London, Dec. 9 was of particular interest as an illustration of the co-operation which may be obtained between the more scientific society and the practical foundrymen.

At this meeting, at which the London branch of the Institute of British Foundrymen was host, the paper presented by H. C. Dews dealt with the subject of contraction and alloy castings. Mr. Dews, who is metallurgist at the firm of Dewrance & Co., London, exposed the results of his scientific investigations in a manner which could be understood by all present.

The lecturer explained, by the comparison of the volume-temperature curves with the time-temperature curves, how most metals or alloys contract during the cooling after having passed the freezing point. He showed that in a few exceptional cases there may be a certain expansion between the limits of temperature and quoted the examples of water and bismuth. He further explained how the cavities, usually termed as shrinkage, result from this phenomena of contraction, and how the operation of casting may be conducted to obtain the cavity in one point so that with proper feeding and the rational use of runners and risers this defect may be remedied.

Mr. Dews explained how that in a number of alloys the process of solidification is accompanied by the formation of a dendritic structure which results in a lower resistance of the casting. In indicating the practical conclusions of these investigations the lecturer pointed out that the principal factors which have an influence on the solidification and cooling of the casting are, the thermal capacity of the material of the mold, the thermal conductivity of the metal itself and the rate of solidification.

The discussion which followed the reading of this paper was opened by Dr. Rosenhain of the National Physical laboratory, Teddington, who said that not enough attention is paid to the effect of gases which are absorbed in the molten metal and which, in escaping during the solidification, cause cavities. Professor Turner of the University of Birmingham, directing his remarks chiefly to pig iron castings, alluded to the skin effect. Answering a remark which the lecturer made at the opening of his address to the effect that little work as yet has been done toward the study of densities of liquid metals, he stated that some work has been done in this direction and that, as a result of his own investigation, the density changes occur in a straight line in most pure metals. With regard to pig iron, a number of anomalies were found. However, Professor Turner said that at their present stage these studies hardly are advanced sufficiently to be published. Mr. A. H. Mundey, chairman of the London branch of the Institute of Metals, pointed out that he often has had occasion to make alloy castings with a precision of about one thousandth of an inch. These castings are used without being machined.

Answering the discussion, Mr. Dews said that he did not contradict the statement that cavities are caused by the escape of gas through the molten metal, but he warned that this factor should not be considered as the only one, and that there is no doubt that contraction is one of the main causes of shrinkage in castings. Replying to Mr. Mundey's remark about the precision of the castings he occasionally manufactures, Mr. Dews stated that this is only possible when dealing with metals with a low freezing temperature.

## Consolidate Firms

K-B Pulverizer Corp. New York, manufacturer of pulverized coal burners has been consolidated with the Illinois Stoker Co., Alton, Ill. The New York office of the Stoker company will be at 1948 Grand Central Terminal building.

# Bill Indulges in a Friendly Argument

By Pat Dwyer

LAST night after the family had retired I sat for an hour in front of a dying grate fire engaged in my favorite occupation of doing nothing. To be strictly accurate perhaps I should qualify that statement to the extent of admitting that I smoked one or two pipes of tobacco, but this form of activity is so nearly automatic and performed so unconsciously that really it does not affect the main statement. Occasionally, this innocent form of amusement or device for passing the time has been criticized as a useless habit and if viewed in that light the claim may be advanced that I was doing less than nothing. However, I never was one to split hairs over such inconsequential details. I said I was doing nothing and I intend to stand by that statement until some duly qualified person submits a reasonable argument to convince me that I am mistaken. Conditions have come to a pretty pass indeed when a man is not supposed to know his own mind. I am a man of peace. I dislike to get drawn into arguments and bickerings and invariably I adopt every reasonable expedient to avoid anything of the kind; but dash it all, a man has to assert himself sometimes. I will not willingly start an argument, but at the same time if I am badgered, bullied, harassed and driven into a corner I will put up as reasonable a fight as may be to defend my views. That is only natural and I trust the statement does not detract from my claim of being a peaceable, law-abiding citizen. Some men constantly go about with a large collection of variegated and gaudy chips on their shoulders. Others, and I trust I am not violating the bounds of modesty when I claim membership in this class, do not either carry chips or look for them on the shoulders of their fellow citizens. However, every man can be pushed just so far. There is a limit, a point where it is either put up or shut up.

I have developed this point deliberately at some length to avoid any possible misunderstanding. Almost without exception I have found that when a person adopts this free and above board method, lays all the cards on the table, the chances for starting an argument are reduced to a minimum, if not destroyed altogether. An argument cannot be started unless there is a peg or two on which to hang it. The size or shape of the particularly peg is immaterial.

Now that harmony has been restored all around, the air purged and sweetened and the dove of peace once more has settled with brooding wings over the scene I think I safely may repeat my former statement to the general effect that on a certain occasion, to-wit: last night, I was sitting peacefully before the fire doing nothing.

There it is a plain, simple, unvarnished statement, without any hidden meanings, quirks or equivocations. To the best of my ability I have stripped away all extraneous material, all features of any kind that might be suspected of clouding the main issue. Straightforward and to the point, that is my method. The Golden Rule, *do unto others as you would have them do unto you*, always has been my motto. I heartily dislike circumlocution, long drawn out and roundabout methods practiced by others in coming to the point. I am a firm believer in the short and snappy approach, as few words as possible and these few directly to the point. Conceivably I might meet some of these long-winded people on their own ground, but I scorn to adopt such tactics.

Why should I use three or four words when one is sufficient? I am quite well aware that some person or persons may be inclined to take me up on this point, but as I said in the beginning I refuse to be drawn into any argument. If I paid attention to every person who tried to inveigle me into arguments of one kind or another I should have time for nothing else. I am no glutton for work, but I feel a conscientious obligation to do a reasonable amount and how can a person do his best work, any kind of work, if he is interrupted constantly by people who apparently never are happy unless they are starting a controversy of some kind? At this point the impatient reader—I trust he is impatient—the only pleasure one derives from writing is the hope that the reader is following eagerly—at this point the reader well may remark, audibly or mentally depending on his interest and temperament, "I wish to high heaven (or any other favorite exclamation) this

HE HAS THE LAST WORD AND IT IS "NO"

here now writing guy would continue writing about whatever he started to write about. I have no intention of starting any argument with him. At the rate he is going the fire in the grate will die out and he will freeze to death before he gets to first base."

Patience, dear friend, patience. 'Tis a grand virtue and well worthy of cultivation. I am in no hurry and since in the present instance I am what is known technically as the party of the first part, it ill becomes the party of the second part to raise objections until the case has been presented fairly for consideration. When I stated some few paragraphs back that I was sitting peacefully in front of the fire doing nothing I wished to create the impression that all was still and silent. I was warm, well fed and comfortable. Not a wrinkle furrowed the placid brow. In a word, to follow my favorite and invariable custom of compressing a great deal of material into the minutest possible compass, all was quiet along the Potomac. Community of interest is an essential factor in establishing a sympathetic bond between writer and reader. If I stated in the beginning that I intended to start a row about something the peaceable reader would be quite justified in throwing the book away. He can get all the fight dope he wants, more than enough, personal, domestic and national in the great educational medium, the daily paper.

My simple statement that I was wrapped in an atmosphere of tranquility sets his mind at rest and assures him that he may proceed with an easy mind and a clear conscience. It is inconceivable that after such a peaceful beginning his feelings will be harrowed or any statements issued that will cause his angry passions to rise.

Now that we are all set, as the saying goes—though why that form of expression is used in preference to others more appropriate and euphonious—I could name half a dozen if I had time—is beyond me. Now that we are all set, I say, let us go back to tbe beginning, where if you remember I said I was sitting in front of the fire doing nothing.

There, there, calm yourself. I have no intention of introducing any further digression.

If I felt so inclined, or if I thought the necessity existed I could defend the comparatively few and simple forms of digression that up to the present have crept into this straightforward discussion. However, the inclination is lacking and to be perfectly frank I do not think the necessity exists. Explanatory details in the form of digressions have their place under certain circumstances, for example in clearing up debatable points or in clarifying doubtful issues, but I quite agree with you they are not necessary in this clear and limpid presentation.

WHAT THE WELL DRESSED MAN IS WEARING

Without attempting to trace or analyze the random train of thoughts that ran through my mind on this occasion while I gazed idly into the fire I found myself eventually reviewing that period of my life when I was engaged in the occupation known at that place and time as learning my trade. Perhaps the fact that I was down that way last summer, coupled with the present Christmas season which invariably turns one's thoughts to the home of his youth, when Christmas was Christmas and not merely the anniversary of a flat pocket book, may have been responsible for turning my thoughts into this channel.

Looking back now I find difficulty in recognizing myself in the carefree young fellow who cheerfully plugged through a strenuous 4-year training period. I certainly should file a vigorous protest if any person tried to persuade me to go through with it again. However, at the time I accepted conditions as they were and felt fairly well content. In fact, before the period of my apprenticeship expired I had attained to such a degree of skill and self confidence that I was inclined to look with a certain degree of condescension on contemporary youths of my acquaintance who had no regular trade.

In later years I found I was not alone. I know men and women today who derive a great deal of pleasure from contrasting their condition with the condition of others whom they imagine are not so fortunate. Usually their belief is founded on no more substantial foundation than mine was at the time of which I write.

Just before I had decided whether to go to bed or stay where I was for the night and thus save the time and bother incident to undressing and dressing, Bill came oozing in through the door and inquired cheerfully what did I know. I told him that while I did not know much, I knew enough to stay at home at night instead of rambling around like a lost soul disturbing sensible people who observed regular hours for retiring and rising. The gentle hint was entirely thrown away on Bill. He drew up a chair to the fire, borrowed a pipefull of tobacco, stretched out his long legs and proceeded to make himself comfortable. Further he intimated that the night was young yet and anyway people wasted altogether too much time sleeping. "You overrate the importance of this regular hour stuff," said Bill. "A man is a fairly adaptable animal and can stand quite a variation in the number of hours he devotes to sleep. In fact whether he wants to or not he has to be an adaptable kind of an animal sleeping or waking. For example consider some of the problems he is up against in the foundry almost every day."

"For heaven's sake man," I said, "is this the time or the place to start talking about the foundry? First thing you know we shall hear a child crying in the street 'Father, dear father, come home with me now, the clock in the steeple strikes one!' "

"Your imagination does you credit," Bill remarked placidly, "but, my dear Watson, your assumption is not supported by the slightest scintilla of evidence. In the first place I only know of one church steeple in this town with a clock in it and that is approximately 8 miles from here. I don't know if that clock strikes the hours or not, I never heard it. Some children have remarkably long ears, but I think you are stretching them too far when you assume they can

catch the chiming of a clock 8 miles across a noisy city. I never knew a kid who could hear a clock even in the next room when it is time to get up in the morning, or for that matter when it is time to go to bed.

"In the second place, none of my children is silly enough to go caterwauling around the street at night seeking a father who was perfectly able to take care of himself for many years before they were born. Even if one of them was weak minded enough to attempt anything of the kind—this merely by way of argument—he or she, as the case might be, would have a fat chance of eluding the vigilance of a certain lady, if you know what I mean. No, no, my dear lad," said Bill. "Make your mind easy. You are not detaining me. I am not in any hurry. I am not sleepy and I don't mind sticking around an hour or so to keep you company. As I was saying—" Heavenly days, I reflected bitterly, people used to think that old piker Job was a martyr. "As I was saying," Bill continued, snuggling down a little deeper into the chair, "circumstances connected with two seemingly identical problems may change them to such an extent that they no longer are in the same class. Methods adopted for the solution of one, if applied to the other quite properly might be regarded as extravagant and unnecessary. Again it is well to remember that the foundryman sometimes is forced to adopt certain measures in the interest of economy which would not be necessary if the job received the consideration to which all jobs are entitled before actual construction begins.

"The usual alibi presented by the foundryman is to the effect that he was not consulted before the patterns were made and, therefore, the only course left for him now is to make the best of a bad bargain. In many cases this alibi is justified, but in other cases it is just another weight added to the long list of errors he will find chalked up on one side of the score board on the final day of reckoning.

"I hold no brief for the patternmaker. In fact I suppose I have had as many rows with him as he has had with me, but I know that many a foundryman does not realize the best method to adope until after he has seen the pattern in the sand.

"He is shown the drawing and invited to make suggestions. He has free access to the pattern shop during the construction of the pattern and even at the last minute may refuse to accept the pattern if it does not meet with his requirements. In the face of all this he accepts the pattern and usually before the first mold is finished he has discovered that if the pattern had been constructed differently or designed to be molded in some other manner, the foundry could produce the castings more economically."

I suggested to Bill that I could see no useful purpose in threshing over this particular stack of old straw.

THE VILLAGE BLAKKESYMTHE OPENS A BEAUTY SHOPPE

"Anyway," I said, "that little game known in America as passing the buck and I suppose by suitable names in other countries, is not confined to men in the foundry industry.

"Furthermore," I continued. "you cannot institute a fair comparison between the methods involved in making a casting and the methods employed in making any other piece of merchandise.

"In the case of almost any other object you may care to mention, the operator has the raw material in plain view all the time and can watch the effect of each succeeding step in the process. He can adjust the tools, the materials or any of the other factors involved to meet changing conditions. If necessary he may stop the operation at any stage to check for accuracy of dimension, temperature or appearance.

"The molder has no such opportunity. He has to plan his course of procedure from beginning to end before he lifts the first shovel of sand. Each succeeding step hinges so closely on the one preceding that he has no choice but to follow his original plan and has no assurance that his calculations are correct and his handiwork all that it should be until after he has filled the mold with metal. If the mold withstands the test successfully he knows that he was right. If it does not withstand the test he has the opportunity of trying to decide which one or which combination out of a possible 57 sources of error is responsible for the catastrophe."

"All that is quite true," said Bill. "But that is not the phase of the question I had in mind when you started one of your everlasting arguments that begin no place in particular and end some place in the same general locality. What I had in mind particularly is that peculiar trait of human nature which prevents a man from admitting he has made a mistake or even that he was guilty of a minor tactical error." "When it comes to minor tactical errors," I said, "if I had the time I should like to hear your justification for creeping into a man's house at midnight to start up an argument about some of the dumb tricks pulled off in the foundry. Did you ever hear the story about O'Brien and the coat hanger?" "No," said Bill, suspiciously. "Who was O'Brien and what did he want with a coat hanger?" "Why," I said, "Geoghogan met O'Brien one day and said, 'Your new coat looks like the devil in a gale of wind, Mike. You only have had it two weeks and it is full of wrinkles. Why don't you use a coat hanger?'

" 'Faith I tried one iv thim things,' says brave Mike, 'but it's no good. The wooden part hurted me shoulders and the hook knocked me hat off, bad luck to it'."

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## To Award Prizes for Arc Welding Papers

To stimulate activity and growth of arc welding, the Lincoln Electric Co., Cleveland, manufacturer of electric welding equipment, has given $17,500 to the American Society of Mechanical Engineers to be used as cash awards for the best three papers on arc welding submitted in a competition. The awards will be $10,000 for first prize; $5,000 for second prize and $2,500 for third prize. Judging of papers and awarding of the prizes will be under the direction of the council of the Society and a special committee to be appointed. Rules of the competition will be announced later.

# Experiment on Clay Bond *in* Molding Sand Heaps

By R. F. Harrington, A. S. Wright and M. A. Hosmer

THE company with which the authors are associated has, for a great many years, given serious consideration to the question of sand conservation, reclamation and control. A review of the records of the technical department, under whose direction conservation and reclamation problems come, shows that in the years 1915, 1916 and 1917 many attempts were made to employ clay as a binder in our molding sand heaps. The records indicate considerable success for a short period of time. On the other hand, serious difficulties cropped up after the bonding material was employed for a longer period of time and apparently the difficulties were insurmountable with the knowledge of sand then at hand.

Since that time the joint committee on molding sand research of the American Foundrymen's association has been formed and has functioned both from the standpoint of the development of standard testing methods and investigation of conservation and reclamation. This has resulted in greater interest throughout the country in sand control and conservation, as evinced by the excellent results submitted in the papers before the American Foundrymen's association meetings in recent years. Standard methods have allowed an interchange of data which formerly was not possible.

With the feeling that possibly previous failure in the case of clay bond had been due to lack of scientific knowledge pertaining to sand, it was not unusual that the company, which for many years has been attempting to reduce new material consumption because of high initial sand costs, should again renew its efforts to make use of a clay bond to that effect.

Previous efforts at the plant had been along conservation lines through the use of more intensive mixing equipment, the results of these investigations having been incorporated in papers prepared for other occasions.

In March and April of the year 1925 exhaustive tests were being made

## Studies Reclamation

*SAND conservation, reclamation and control has been given serious consideration for some time by the company with which the authors are associated. The article, which is from a paper presented at the Detroit convention of the American Foundrymen's association, Sept. 27 to Oct. 1, outlines the work that has been done in using clay bond in molding sand heaps.*

M. A. Hosmer, joint author of the paper, is a native of Concord, Mass. He received his preliminary education in the public schools of Concord, later attending Tufts college, being graduated from this latter institution in 1919 with the degree of B. S. in chemistry. Since completing his work at Tufts college he has been associated with the Hunt-Spiller Corp., Boston, as chemist. In this capacity he has been interested in research work on molding sand and has contributed papers before past conventions of the American Foundrymen's association on this subject. Mr. Hosmer is a member of the American Foundrymen's association.

M. A. Hosmer

R. F. Harrington, joint author of the paper, is metallurgist with the Hunt-Spiller Mfg. Corp., Boston, having been associated with this company for the past 13 years as chemist in charge of laboratory, and is now metallurgist in charge of the metallurgical operations, testing of materials, and all operations connected with molding sand research and conservation.

R. F. Harrington

Mr. Harrington was graduated from Tufts college in 1913 with the degree of bachelor of science. He is a member of the American Foundrymen's association, American Society for Testing Materials, iron and steel committee of the American Institute of Mining & Metallurgical Engineers; a member of the executive commitee of the joint committee on molding sand research, chairman of the subcommittee on conservation and reclamation; and was president of the New England Foundrymen's association for the 1925 term.

A. S. Wright, joint author of the paper, is assistant metallurgist with the Hunt-Spiller Mfg. Corp., Boston. He was educated in the public schools of Boston and the Northeastern college of that city, being graduated from the latter institution in 1918, after having specialized in chemistry. During his attendance at Northeastern college, he was employed in the laboratories of the Hunt-Spiller Corp. as student engineer. Immediately on graduation he entered the employ of this corporation and has remained in its employ ever since. Mr. Wright is a member of the American Foundrymen's association and has contributed to its technical program.

A. S. Wright

with ordinary high quality Jersey clays. However, clays employed were not proved clays in the sense that they had been employed with any particular success, at least to the knowledge of the authors. In the early part of this investigation there came to the attention of the foundry and metallurgical department a well-known clay bond which from authoritative sources, showed considerable success in a number of eastern plants. This material was presumably an especially prepared clay and because of the satisfactory results reported, it was decided to abandon the tests with the untried clays and employ the better known product.

The authors will endeavor in this paper to cover from a practical standpoint the many problems which were encountered in an effort to successfully employ this material in molding sand heaps. Throughout the entire period of investigation and research, quality and appearance of castings were held to be first or paramount and economy of sand second. Of course the rebonding of molding sand heaps by the addition of a clay is not a new problem, as this is common practice in the case of steel foundries and is to a small degree the practice in the gray iron foundry.

In the tables that follow reports are given as to the condition of the casting, both in the cleaning room and in the machine shop. Reference to condition in the cleaning room refers to general appearance of the casting, ease of cleaning, etc. In the case of the machine shop, the report refers to the condition of the casting after ⅛-inch has been machined from the surface of the casting and refers particularly to sand inclusions, or inclusions of material from the surface of the mold which appeared directly beneath the skin of the casting.

Realizing fully that no arbitrary standard may be made without knowledge of the practical working of the sand, permeability and strength tests, with all other factors, were in every instance correlated with the practical aspects of the sand.

### Mulling Found Desirable

First attempts to employ the clay bond were made with the addition of the clay into the heaps only by means of hand mixing and screening. As high as 5 to 10 per cent of clay bond was employed in this respect, but the sand was clearly not of such a character as to be workable. A further test of only two or three days was required to indicate the desirability of mulling the heaps at least until such time as the clay was thoroughly incorporated, and thus became the basis for further additions.

The castings selected for the first test were approximately 150 pounds in weight, cylindrical in character and of 1⅛-inch section. The first two castings produced when the muller was employed were excellent castings in every respect. In this instance 91 per cent of old sand and seacoal was employed with 9 per cent of clay bond. This mixture showed remarkably high strength tests, and, therefore, the muller was discontinued in the belief that having once incorporated the clay thoroughly it might be possible to incorporate smaller additions by means of the hand mixing method.

Thereafter mixtures employed approximately 97 per cent of old sand and seacoal, the balance being composed of clay, as indicated in Table I.

Excellent castings were produced under these conditions, at least so far as machine shop reports were concerned, every casting showing satisfactory after ⅛-inch had been removed for finish. However, the castings were considerably rougher in outside appearance than those produced under regular operation. Therefore, seacoal was added at this time in somewhat greater quantity.

The next series of tests, involving 14 castings, as illustrated in Table II, employ a larger percentage of seacoal with clay bond varying from 2½ to 3½ per cent. Here again the sand was mixed entirely by hand—that is to say, shovel mixed and screened. The permeability tests showed definite tendencies toward lower levels, and similar conditions existed in the case of the cohesiveness test and per cent clay present.

Here we have two conditions, it is believed, contributing toward the unsatisfactory showing that was made. An excess of moisture present for the low percentage of clay with consequent reduction in permeability and a fictitious strength or cohesiveness that

Table I

## Sand Mixed With Mulling Machine

| Per cent old sand | Per cent clay bond | Per cent sea-coal | Permeability number | Cohesiveness number | Per cent moisture | Per cent clay | Mixing method |
|---|---|---|---|---|---|---|---|
| 89 | 9 | 2 | 138 | 282 | 7.2 | 15.9 | muller |
| 95 | 3 | 2 | 146 | 175 | 7.4 | 12.4 | hand |
| 95 | 3 | 2 | 156 | 188 | 7.5 | 14.0 | hand |
| 95 | 3 | 2 | 173 | 196 | 7.6 | 13.9 | hand |

Table II

## More Sea Coal Added to Sand

| Per cent old sand | Per cent clay bond | Per cent sea-coal | Permeability number | Cohesiveness number | Per cent moisture | Per cent clay | Number Castings made |
|---|---|---|---|---|---|---|---|
| 88½ | 2½ | 9 | 75 | 179 | 7.8 | 11.4 | 2* |
| 96 | 2½ | 1½ | 108 | 169 | 8.0 | 11.8 | 2* |
| 97½ | 2½ | 0 | 138 | 142 | 8.2 | 10.3 | 2* |
| 95 | 5 | 0 | 142 | 145 | 8.2 | 11.0 | 2* |
| 96½ | 3½ | 0 | 115 | 170 | 8.5 | 11.0 | 2* |
| 96½ | 3½ | 0 | 119 | 195 | 7.9 | 11.7 | 2* |
| 96½ | 3½ | 0 | 115 | 188 | 8.6 | 13.0 | 2* |

Machine Shop Report: *2 poor or rejected.

Table III

## American Foundrymen's Association Test

| Mixture—By Volume | | | A. F. A. Tests Report | | | | |
|---|---|---|---|---|---|---|---|
| Per cent old sand | Per cent clay bond | Per cent sea-coal | Permeability number | Cohesiveness number | Per cent moisture | Per cent clay | Number Castings made |
| 95¼ | 4¾ | 0 | 142 | 270 | 7.7 | 16.7 | 2* |
| 96⅞ | 0 | 3⅛ | 124 | 238 | 7.1 | 17.0 | 2* |
| 90¾ | 5 | 6¼ | 122 | 290 | 7.5 | 17.0 | 2* |
| 98¼ | 1¾ | 0 | 160 | 236 | 7.8 | 16.8 | 2‡ |
| 96¾ | 3¼ | 0 | 151 | 249 | 7.5 | 14.5 | 2* |
| 96⅞ | 3⅛ | 0 | 171 | 235 | 6.9 | 14.8 | 2* |
| 96⅞ | 3⅛ | 0 | 161 | 235 | 7.5 | 15.4 | 2* |
| 98¼ | 1¾ | 0 | 146 | 268 | 8.2 | 17.3 | 2* |
| 98¼ | 1¾ | 0 | 161 | 266 | 8.1 | 17.6 | 2† |
| 95¼ | 1½ | 3¼ | 125 | 242 | 8.3 | 17.2 | 2‡ |
| 97 | 1½ | 1½ | 138 | 248 | 8.1 | 16.0 | 2† |
| 97 | 1½ | 1½ | 107 | 246 | 8.1 | 15.9 | 2* |
| 97 | 1½ | 1½ | 105 | 242 | 7.8 | 16.4 | 2* |
| 98¼ | 0 | 1¾ | 112 | 255 | 7.2 | 16.4 | 2* |
| 87 | 1½ | 11½ | 110 | 235 | 7.5 | 14.4 | 2* |

Machine shop report: *2 satisfactory; ‡1 fair and 1 satisfactory; †1 satisfactory; ‡1 satisfactory and 1 passable.

Table IV

## Muller and Aerating Unit Used

| Sand Number | —Before Passing Through Aerator— Per cent moisture | Permeability number | Cohesiveness or bond test | — After Passing Through Aerator— Per cent moisture | Permeability number | Cohesiveness or bond test |
|---|---|---|---|---|---|---|
| 1 | 8.25 | 126 | 250 | 8.2 | 140 | 228 |
| 2 | 7.50 | 140 | 228 | 7.5 | 165 | 208 |
| 3 | 8.8 | 127 | 223 | 8.78 | 156 | 203 |

was incapable of producing satisfactory castings. It is quite evident that the low permeability of 75 was brought about through the immediate introduction of seacoal to a large extent, which was added for the purpose of obtaining smoother and more satisfactory castings.

This was followed by a reduction in seacoal, and as indicated by Table II, an entire elimination of seacoal for the balance of time involved. It is to be noted that there were 14 castings reported as poor or rejected by the machine shop.

### Objections Raised

One might well ask the question, "Why, if the clay content is low, was there not more clay added?" This would be a perfectly logical question and can only be answered by stating that the clay content could not be increased by greater additions without a further reduction in permeability. That is to say, the clay by the mixing operation as employed was incapable of being properly incorporated around the sand grains.

It is our belief that the large number of poor castings produced was due to a lack of proper strength in the sand. This, we believe, to have been a factor more important even than the permeability. To be sure in the last two instances we have a cohesiveness of 195 and 183, which under ordinary circumstances would indicate a sufficiently strong sand, yet a condition of weakness actually existed as measured by the usual foundry standards of feel, etc. It is unfortunate that occasionally the tests do not apparently detect the true conditions.

After exhaustive tests the authors have come to the conclusion that permeabilities in excess of 115 for this class of work are desirable, although we believe the cause of defective castings in this instance was lack of strength. The sand apparently did not have sufficient strength to withstand the action of the metal in the mold. It is to be understood that in all instances the sand referred to is a green sand mixture.

At this time the authors have thought it desirable to mention certain experiences wherein mold permeability, or ability to conduct the gases away from the mold, play an important part in the production of good castings. A sand of the following characteristics was employed in the test and the test was based upon the theory that an unvented flask produced a condition within the mold that prevented proper escape of gases, and, therefore, the group of castings were made from the same sand both in vented and unvented flasks. The characteristics of the sand follow:

| | | |
|---|---|---|
| Permeability, | 190 | average. |
| Cohesiveness, | 190 | average. |
| Moisture, | 8.2 | per cent. |
| Clay, | 13 | per cent. |

The test involves 52 castings in each case.

The machine shop reported in the case of the unvented flask, 78.8 per cent good castings and 21.2 per cent of the castings containing sand inclusions.

In the case of the well vented flask, and by this we mean a flask having 3.6 per cent of its surface vented, the machine shop reports 92 per cent good castings and 8 per cent containing slight sand inclusions.

Our belief in reference to the trapping of the sand by the metal in the unvented flask is that the gases which are given off within the body of the mold have no outlet except at the joint. There being a large volume of sand involved between the joints, the gases seek the lines of least resistance. This escape of the gases the authors believe takes particles of sand and graphite facing from the mold surface. These are engulfed by the rising metal and are thrown toward the mold walls, later to be found beneath the skin of the casting upon machining. This condition was frequently observed in open molds and we believe the theory has been proved conclusively that the unvented flask is a hazard not only as indicated by the results tabulated above, but proved many times in addition.

It is noted that the permeability of the sand used in the test involving the vented and unvented flask is relatively high. It is the authors' opinion that with the low permeability prevailing in the use of clay bonded heaps, the vented flask is even more essential. All flasks throughout the entire shop were vented after this test. It is the belief that the thorough venting of the flask has to some extent assisted in the problem of mold permeability or the ability to carry away gases contained within the mold without excessive venting on the part of the molder and thus indirectly assisted in the use of clay bond.

### Obtaining Desired Strength

As a consequence of belief that a higher clay was needed, the next step was to employ a sand of higher clay content which would insure greater strength and a means of mixing which would insure greater blending of the different ingredients with consequent elimination of the tendency toward a low strength sand. Table III shows the mixture of sand employed, together with the physical tests obtained and the machine shop report pertaining to these castings.

In the case of the series of castings of Table III, it may be noted that a higher clay content is employed. This is in line with the desired change involving higher clay content sands. Furthermore, the muller type of mixing unit had its effect in producing a better blending of the clay and old sand with its seacoal quota, with a consequent in-

Table V

## Using Paddle Type Mixer

| —Mixture—By Volume— Per cent old sand | Per cent clay bond | Per cent sea-coal | —A. F. A. Tests Report— Permeability number | Cohesiveness number | Per cent moisture | Per cent clay | Number Castings made |
|---|---|---|---|---|---|---|---|
| 94 | 5 | 1 | 201 | 219 | 9.1 | 16.6 | 1* |
| 94 | 5 | 1 | 201 | 214 | 9.0 | 16.9 | 5* |
| 94 | 5 | 1 | 215 | 217 | 8.8 | 16.4 | 5* |
| 94 | 5 | 1 | 198 | 243 | 8.8 | 18.2 | 5* |
| 94 | 5 | 1 | 173 | 238 | 8.9 | 18.6 | 5* |
| 95½ | 3 | 1½ | 185 | 236 | 8.8 | 18.0 | 5* |
| 95½ | 3 | 1½ | 205 | 214 | 8.7 | 15.1 | 5* |
| 95½ | 3 | 1½ | 198 | 222 | 8.7 | 17.3 | 8* |
| 95½ | 3 | 1½ | 178 | 216 | 8.5 | 18.1 | 10* |
| 95½ | 3 | 1½ | 156 | 214 | 8.7 | 16.2 | 20* |

Condition in cleaning room: *Satisfactory.

crease in the strength of the sand, likewise a reasonably high permeability in the face of a higher clay content, was obtained.

The theory in connection with the muller has been that the mulling action so coats the various grains of old sand with the clay that the clay is removed from the voids, thus not only gaining strength, but maintaining relatively satisfactory permeabilities. In the case of other means of mixing, especially where clay is added in the raw state, and especially in sands with relatively high clay content, the clay seems to remain between the voids, thus limiting the extent to which clay can be added because of its effect on reducing permeability.

That the belief that a high strength sand was needed in connection with the castings, as illustrated in Table II, was correct, seems to be borne out by the excellent results obtained in the castings illustrated in Table III.

Satisfactory results having continued on the small class of castings, i. e., on castings weighing 100 to 150 pounds, this part of the shop was put over on a production basis until all of the castings of this class, involving some 100 to 200 in number, were made with sand employing clay bond as part of the mixture to the extent of 1 to 2 per cent. From time to time poor castings were obtained and the physical properties of the heaps had to be watched closely, especially for strength and permeability.

### Mechanical Mixing and Handling

The amount of seacoal, or character of seacoal as to fineness, in the sand, was another troublesome factor. At one time the loading of sand from the muller into the transfer bucket was a cause of uneven mixing of material with its consequent effect. The sand as it was discharged from the muller fell into the boot of a bucket conveyor which elevated the sand to a point at which it could be discharged into buckets. As the sand fell from the chute into the bucket a cone of very fine material was formed, the pebbles or coarse material collecting at the outer edges. As the basis of this sand is a coarse material of the nature of Millville gravel, this separation becomes of serious moment. This happened in spite of the fact that the sand had all passed through a ¼-inch mesh sieve as received from the producer. Mention of this is made merely to indicate some of the difficulties that may occur in the handling of sand of this character. The result, so far as castings were concerned, was that the separation at this point caused coarse material frequently to come in contact with the pattern with consequent rough castings. This condition was aggravated by the fact that the molds are not faced, the entire heap being of facing quality.

As the work progressed it became evident that beyond a certain point it was next to impossible to increase the permeability of the sand where the muller was used as a mixing unit. This applied particularly to the heavier types of castings when the entire shop went over on a production basis. However, it was found that a sand aerator of the belt type could be used with the muller and that this machine would open up the sand to an effective degree. Accordingly all sand after coming through the muller was put through the aerating unit. The result is seen in Table IV.

### Proper Jolt Ramming Important

At this time the records show the serious effect of improper jolting. In one day, for example, where the number of jolts was increased 20 per cent over that considered standard, we had 66 per cent rejected castings because of scabs on one particular floor. Resuming the standard number of jolts, 100 per cent perfect castings were obtained. It its barely possible that in the early stages of clay bond additions the heaps were frequently on what one might term *the ragged edge*. Thus it was easy to throw them out of balance either from the standpoint of the sand itself or by slight deviations from standard manipulation in the foundry.

We continued making approximately 30 castings per day of this type for some few weeks, gradually increasing, the amount of work made with clay bond material on some of the other floors. This was planned to have a sufficient number of heaps and a sufficient tonnage of sand actually in production to observe any operating difficulties that invariably occur.

As the use of clay bond became more and more extensive, the problem of a mixing unit began to present itself. Although machinery for loading and discharging the muller had been installed, it was not possible to further increase the amount of work handled by the one unit to take care

Table VII

## Progress Report of Sand

| | Mixture—Per Cent, by Volume | | | | Physical Properties | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Group | Old sand | New sand | Clay bond | Fire sand | Permeability number | Compression test | Per cent moisture | Clay content | Dye adsorption |
| A | 62 | 38 | ..... | ..... | 347 | 8.25 | 7.7 | 12.4 | 500 |
| A | 62 | 38 | ..... | ..... | 345 | 7.90 | 7.7 | 12.1 | 508 |
| A | 62 | 38 | ..... | ..... | 359 | 7.75 | 7.6 | 10.8 | 504 |
| A | 62 | 38 | ..... | ..... | 332 | 8.44 | 7.9 | 12.0 | 516 |
| A | 62 | 38 | ..... | ..... | 346 | 7.64 | 7.9 | 11.6 | 472 |
| B | 78½ | 18½ | 3 | ..... | 341 | 7.13 | 7.7 | 13.0 | 540 |
| B | 80 | 9¼ | 1½ | 9¼ | 300 | 6.50 | 7.9 | 13.2 | 472 |
| B | 80 | 13¾ | ..... | 4¾ | 275 | 6.50 | 7.7 | 13.0 | 464 |
| B | 80 | 13¾ | ..... | 4¾ | 287 | 6.38 | 7.4 | 13.4 | 424 |
| C | 80 | 13¾ | 1½ | 4¾ | 253 | 6.50 | 7.1 | 14.1 | 400 |
| C | 80 | 13¾ | 1½ | 4¾ | 253 | 6.50 | 7.1 | 14.1 | 400 |
| C | 80 | 13¾ | 1½ | 4¾ | 275 | 6.13 | 7.2 | 14.4 | 408 |
| C | 80 | 13¾ | 1½ | 4¾ | 264 | 6.38 | 7.4 | 13.8 | 384 |
| C | 80 | 13¾ | 1½ | 4¾ | 287 | 6.00 | 7.1 | 14.6 | 408 |
| D | 80 | 13¾ | 1½ | 4¾ | 264 | 7.25 | 7.5 | 15.7 | 424 |
| D | 80 | 13¾ | 1½ | 4¾ | 275 | 7.33 | 7.4 | 15.6 | 444 |
| D | 80 | 13¾ | 1½ | 4¾ | 287 | 8.17 | 7.5 | 16.5 | 416 |
| D | 80 | 13¾ | 1½ | 4¾ | 248 | 8.00 | 7.5 | 15.7 | 412 |
| E | 80 | 14¼ | ¾ | 5 | 326 | 6.63 | 7.9 | 13.5 | 368 |
| E | 80 | 14¼ | ¾ | 5 | 306 | 6.63 | 7.1 | 13.9 | 384 |
| E | 80 | 14¼ | ¾ | 5 | 275 | 6.50 | 7.1 | 13.4 | 412 |
| E | 80 | 14¼ | ¾ | 5 | 275 | 6.54 | 7.1 | 13.5 | 408 |

Table VI

## Sand Mixed With Sand Cutting Machine

| Mixture—Per Cent, by Volume | | | | | Physical Properties | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Old sand | New sand | Clay bond | Sea-coal | Fire sand | Permeability number | Co-hesiveness number | Compression | Per cent moisture | Per cent clay content |
| 88½ | 8 | 2 | 1½ | 0 | 193 | 196 | ..... | 8.4 | 13.6 |
| 88½ | 8 | 2 | 1½ | 0 | 178 | 198 | 8.38 | 8.4 | 14.5 |
| 88½ | 8 | 2 | 1½ | 0 | 163 | 190 | 8.00 | 8.3 | 14.2 |
| 88½ | 8 | 2 | 1½ | 0 | 163 | 198 | 8.13 | 8.1 | 14.8 |
| 88½ | 8 | 2 | 1½ | 0 | 156 | 190 | 6.75 | 8.1 | 13.6 |
| 88½ | 8 | 2 | 1½ | 0 | 151 | 191 | 7.13 | 8.1 | 13.6 |
| 88½ | 8 | 2 | 1½ | 0 | 151 | 184 | 7.00 | 8.1 | 13.9 |
| 88½ | 6 | 2 | 1½ | 2 | 156 | 192 | 7.25 | 7.8 | 14.8 |
| 88½ | 6 | 2 | 1½ | 2 | 151 | 186 | 8.38 | 7.7 | 14.6 |
| 88½ | 6 | 2 | 1½ | 2 | 163 | 184 | ..... | 8.0 | 14.3 |
| 88½ | 6 | 2 | 1½ | 2 | 146 | ..... | 7.13 | 7.5 | 14.0 |
| 88½ | 6 | 2 | 1½ | 2 | 163 | 184 | 7.56 | 8.0 | 14.3 |

of any further extension of clay bond in the heap. It was therefore thought desirable to try mixing some of this material in a paddle type of mixer which was available. A few castings were made each day with sand mixtures and results as indicated in Table V.

A study of Table V reveals higher permeabilities and slightly lower cohesiveness values than were obtained by use of the muller and aerator machine. The unusually high clay content was employed to insure high strength by this means of mixing. It was recognized early that the method was capable of producing higher strengths than anticipated and, therefore, the clay was immediately cut to 3 per cent and ultimately to approximately 1½ per cent, with satisfactory strength tests. The sand in this case was not put through the aerator, as the permeability obtained directly was sufficiently high in itself. As the table shows, the castings were good and this method of mixing apparently was satisfactory.

### Preventing Scabbed Castings

At this point in the investigative work, in those heaps that had been put over on a productive basis scabby castings more or less were encountered frequently. This character of defect proved extremely difficult to overcome. Relief was sought in sands of greater strength and of greater permeability, but apparently it was impossible to avoid the tendency entirely for scabbed castings were made, particularly in certain classes of work, in spite of physical tests that apparently should give sand satisfactory and capable of producing good castings. It is to be appreciated that there had been no new sand added to these various heaps since the inauguration of clay additions which, at this time, involved a period of some two or three months. We were not free from this character of defect until replenishment of the heaps with a certain percentage of new sand, and here apparently the small percentage of new sand, varying from 4 to 8 per cent, was sufficient to produce within the sand characteristics which eliminated to a great extent the tendency toward scabbed castings.

More or less experimental work in connection with clay bond as a partial substitute for molding sand had now been carried on for a period of approximately five months. The work had passed through the stages of a one or two castings per day basis on one floor to dozens of castings per day on three or four floors. The method of mixing, as indicated, had been changed so as to meet additional requirement and the properties of the various heaps and condition of the resulting castings had been closely observed.

Before the advent of clay bond there had been added a certain percentage of new sand to the molding sand heaps each night, the percentage varying with the character of the work. The process of mixing consisted of the distribution of the new sand and its seacoal quota through the heaps, followed by the mixing operation which consisted of running the sand cutting machine through the heaps three times with consequent screening through a 1-inch screen. This process is not described in further detail because it is felt that the process is generally familiar to all foundrymen.

This method of mixing when used in connection with percentages of new sand varying from 20 to 35 per cent, seemed to be quite satisfactory from a mixing standpoint, although the mixing was not sufficient to rid the heaps of all evidence of new sand. The method, as is well recognized, resulted in a low sand handling cost. We had tried this method of mixing the clay bond with the heaps for a few days during the early investigative work. It seemed impossible to gain the desired strength and, therefore, as has been stated earlier in the paper, the process was abandoned. However, when the time came to further increase the use of clay bond and the capacity of both the paddle wheel type of mixer and the muller type of mixer had been reached, the problem of sand handling became acute. This was not only in connection with the purchase of new mixing equipment, but also with the amount of handling which was increased to a considerable extent due to the necessity of bringing the old sand to a central mixing plant. This was in contrast to the former practice of bringing the new material to the molding floors where it was mixed, as previously described.

Interference with crane operation, both when cranes were handling metal and assisting molding operations, was of serious consequence. In fact, this interference, because of the large tonnage of sand involved, made any attempt to utilize the central mixing idea almost prohibitive.

With the desire to extend the use of clay bond, we were, therefore, faced with the necessity for other means of mixing. For this reason we resorted again to the sand cutter method, although as has been indicated the muller and the paddle wheel type of mixer were doing their work well.

A careful study of the possibilities of the sand cutter resulted in the feeling that with more care in the distribution of the new material, together with an increased number of cuttings, it could be made a success. The number of cuttings was increased to 11, and with this added cutting, and the attention to other details, we were successful in introducing the clay bond plus the small percentage of new material to the extent of 4 to 8 per cent.

Physical properties of the heaps were readily maintained, as evinced by Table VI.

### Control Testing Methods Important

The laboratory in the meantime had definitely determined that the compression test offered a better means of checking the strength characteristics of the heap, and consequenly it was substituted for the cohesiveness or bond test as a routine control check on the sand. The compression values are included in Table VI as well as the cohesiveness or bond test.

The sand as produced by the sand cutter was not as high in permeability as was anticipated, although satisfactory castings were obtained. An attempt was made after the seventh day to increase the permeability by the addition of 2 per cent of fire sand. A study of the results in Table VI indicates no change in permeability with a slight decrease in cohesiveness. Consequently fire sand was taken out of the mixture to maintain the required strength.

Percentage of clay bond was kept at 2 per cent and during the course of the next few weeks lower permeabilities were encountered with increasing clay content. It was apparent that 2 per cent of clay was more than was needed to maintain the proper strength. Clay bond was consequently left out of the mixtures for a few days and then added at the rate of 1½ per cent per day. The same results were obtained using this percentage but it took a longer period to develop. After much experimenting the clay bond was dropped as low as ½ of 1 per cent. It was found, however, that the heaps were below the required strength. At the present time ¾ of 1 per cent is giving good results. This is apparently the percentage best suited for the work and is capable of being distributed through the heaps by the sand cutter method of mixing.

Although the physical properties of

# IDENTIFYING NONMETALLIC INCLUSIONS IN IRON AND STEEL

By William Campbell and G. F. Comstock

In actual work, while it is often comparatively easy to identify the larger and more characteristic inclusions such as typical manganese sulphide, iron silicate, oxide, sand grains, etc., there are always some inclusions whose identity is in doubt. The reason for this at once is evident if we consider the constitution of the various sulphides, oxides, silicates, etc. For example, when we examine a sample of puddle slag or tap cinder, which has been allowed to solidify and cool comparatively slowly, the structure is quite coarse and the different constituents have crystallized out in regular order and can be identified, but when we examine slag inclusions in wrought iron we find, in one and the same section, quite a variety of inclusions varying in structure and apparently in composition from what we consider to be pure oxide or pure silicate. That the silicate is variable there can be little doubt. In steel the variation is probably even greater. Slag inclusions in steel are probably solid solutions of manganese and iron silicates in acid steel, but in basic steel are generally duplex in structure and show grains and sometimes crystals of oxide, etc., surrounded by a matrix of silicate. In the same way manganese sulphide may contain over 50 per cent of iron sulphide in solid solution and its color changes correspondingly. Probably what we generally term *iron oxide* contains more or less manganese oxide in solution.

As these various sulphides, oxides, and silicates vary in composition, so will their etching characteristics vary to a greater or less extent, and this must be considered in any systematic method of determination.

Since 1921, considerable work has been done on this subject and a number of new methods of etching have been tried or suggested. Mr. Comstock has tried out a number of reagents and the accompanying table on Data Sheet No. 652, has been worked out with a view to simplify methods of determination. Where two methods equally definite in their results were available, the simpler was chosen to make the scheme of easy application in routine work, where time is a serious factor. For research work, in contradistinction to routine determinations, the more elaborate and lengthy methods may be used.

### Determination of Inclusions in Steel

Polish carefully with minimum pitting, and project magnified image on ground arc or equally white light, without color screen. Note color.

Abstracted from the *Proceedings* of the American Society for Testing Materials, vol. 23, part I, 1923.

(*Concluded on Data Sheet No.* 652)



# IDENTIFYING NONMETALLIC INCLUSIONS IN IRON AND STEEL

(*Concluded from Data Sheet No.* 651)

*A. Gray or black inclusions.*—

Etch with 10-per cent nitric acid in alcohol for 10 seconds.

*Attacked* = lime compound from mold wash.

Unattacked, etch with 10-per cent chromic acid in water for 5 minutes.

*Attacked* = Manganese sulphide.

Unattacked, etch in boiling alkaline sodium picrate for 5 minutes.

*Attacked* = Manganese oxide.

Unattacked, etch in strong boiling KOH for 10 minutes.

*Attacked* = Manganese silicate.

Unattacked, etch with strong solution of stannous chloride in alcohol for 10 minutes.

*Attacked* = Iron oxide. (May be checked by electrolytic reduction with nascent hydrogen, when FeO is reduced to metal and other inclusions are either attacked or unchanged.)

Unattacked, etch with fairly strong HF solution (McCance sol. B) 10 minutes.

*Attacked* = Iron silicate.

*Unattacked*, repolished and note color and form:

1. Quite dark color, fine particles difficult to polish without pitting, not elongated by hot work = Alumina.
2. Color not especially dark, easily polished smooth without pitting:
   (*a*) Fairly large angular fragments, showing changeable bright spots as focus is changed = Sand grains (in steel castings).
   (*b*) Small angular particles, bluish in color, without changeable bright spots = Probably titanium oxide (in titanium treated steel).

*B. Brown, yellow, red or purple inclusions.*—

Etch in strong boiling KOH or alkaline sodium picrate for 10 minutes.

*Attacked* = Iron sulphide.

Unattacked:

1. Purplish color, rather easily polished smooth = Chromium oxide.
2. Pink color, strongly angular form, rather difficult to polish without pitting = Titanium cyano nitride.
3. Yellow, cubes or cubic forms = Zirconium nitride.



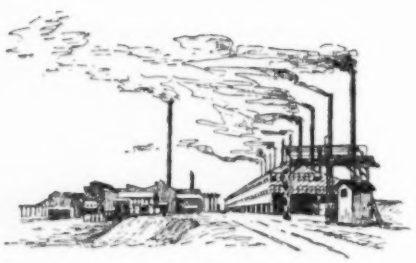
THE FOUNDRY DATA SHEET, JAN. 1, 1927

Payment will be made for all contributions on foundry and pattern shop practice suitable for publication

Note—This sheet may be cut into two sections, 5 x 7 inches, and may be readily bound in notebook form.

# Seeing America with The Foundry

## *Little Journeys to the homes of our readers*



Steel Works,
near Birmingham

**ALABAMA FOUNDRIES**
**TOTAL NUMBER 97 of which**

90 Melt Gray Iron
5 Exclusive Nonferrous
33 Nonferrous Depts. of other foundries
2 Melt Malleable Iron
4 Melt Steel
26 Melt Aluminum

ALABAMA the COTTON STATE was visited by De Soto in 1541, but was not then colonized, and was a part of the British Carolina grant of 1663. At Mobile Bay in 1702 the French established a settlement and the present city of Mobile was founded in 1711.

This state is almost as large as Maine, New Hampshire and Vermont combined and has a population of 2,348,174. The northeastern portion of the state extending southward as far as Columbus, Ga., and westward, including the Cumberland Plateau, is rich in minerals. Within this area are extensive deposits of iron ore and of bituminous coal. The latter is mined to the extent of over $25,000,000 a year. The city of Birmingham has been made the greatest town in the state by the coal, iron and steel industries which center there. Its annual output of iron is about 2,500,000 tons. In iron ore production Alabama is now exceeded only by Minnesota and Michigan.

Smelting works, foundries and coke ovens in the mineral regions, saw-mills in the forests, distilleries for the manufacture of turpentine and resin and factories for the manufacture of cotton goods are the leading industries. These place this state in the front rank of the manufacturing states of the Union.

*In ALABAMA—THE FOUNDRY has 61 paid subscribers*

## "Wherever metals are cast you'll find THE FOUNDRY"

the sand were unchanged, periods came (perhaps only every month or so) when it was necessary, because of excess cutting, to give the heaps an appreciable "shot" of new sand. This amounted to usually about 30 per cent and was kept up for only one day. It has thus far been impossible to detect this condition except by close examination of the castings made from the heap, and we are unable at this time to suggest what the new sand does or what remedy outside of new sand can be used.

### Dry Sand Work

Up to this time no mention has been made of work other than green sand and as the use of clay bond had been extended to castings made in dry sand, it is interesting to study the progress of clay bond in this connection.

The heap itself had always been a mulled sand so the method of mixing has not changed to this date. Table VII shows the progress of this heap from the time clay bond was started until the present time. Group A includes the mixture previous to the use of clay bond. The table further shows mixtures and conditions of heaps as measured by the American Foundrymen's association tests and is composed of four representative days selected at approximately one month intervals.

A study of Table VII reveals several interesting features when result obtained on heaps having clay bond additions are compared to those in which new and old sand only is employed. These features are:

(1) Lower, although uniform, permeability with varying amounts of clay bond.

(2) Generally lower compression values, with apparent inability to develop strength with increased clay content as might theoretically be assumed.

(3) Lower moistures varying with different percentages of clay, as shown in groups C, D, and E. The moisture present was low in relation to the clay present.

(4) Increasing clay content from 11½ per cent in group A to 16 per cent in group D, and a decrease to 13½ per cent in group E when clay bond per cent was reduced in the heap.

(5) Decrease in dye adsorption with increased clay content showing lower colloidal value of clay, also accounting for low moisture content.

The authors at this time cannot make any statement of the value of clay bond to the general users of molding sand, but have endeavored to relate their experience in trying to make use of it in the conservation of new sand.

The American Foundrymen's association permeability apparatus was found to be most useful in the foundry while working with clay bonds. Although strict attention was paid to the various characteristics of the heap as may be realized by the fact that some 17,000 sand determinations were made in the sand laboratory during the past year, havoc could be wrought if the sand was misused by the foundry through improper jolting or ramming.

The permeability of the mold, as determined by the permeability apparatus made by Cornell university, made a valuable supplement to the study of the sand.

The molding sand heaps, throughout the entire plant, now employ clay bond. An appreciable saving has been made through its use. However, more important quality has been maintained, which, as stated early in the article, was paramount.

Rejections, in spite of the use of clay bond and its early difficulties, have not exceeded previous periods when it was not employed.

As representative of the possibilities our experience indicates a saving of approximately 60 per cent in the case of both new sand and seacoal. To this must be added a material saving in handling charges, both within the foundry and to the waste pile.

It has required the undivided attention of the technical department and the foundry to make a success of clay bond additions. It has required the closest co-operation between the two departments and the recognition of the problem involved both from the technical and practical standpoint.

A few statements based upon the authors' experiences might assist the new user of clay bond and they are gladly given in this spirit.

(1) Add clay bond in small percentages. (The tendency has been to employ clay bond to excess.)

(2) Distribute the clay bond uniformly and mix the heap involved intimately and uniformly as your particular case may demand.

(3) Add new sand to mixtures regularly or occasionally. This may keep your heaps away from the *ragged edge* and be economy in the long run.

(4) Make every effort to determine every characteristic of the molding sand heap, both in the plant and in the laboratory. It is slight changes in certain characteristics and recognition of these that tends toward success or failure.

(5) Take advantage of the American Foundrymen's association tests, employ them to the fullest extent. Through their intelligent use your molding sand problems and the use of clay bond will be less difficult.

(6) Watch for accumulation of clay and seacoal.

(7) Pay strict attention to the amount and fineness of seacoal. It has a marked effect on permeability.

(8) If you are limited to a minimum number of tests, make frequent use of the permeability and the compression tests and know the permeability of your molds after having been jolted or rammed up.

The authors feel that their particular problem at least was not easy in that each casting is subjected to a critical inspection when shipped to the customer as an unmachined casting. When it is further realized that the casting before being used by a consumer is machined to at least 95 per cent of its area and must be practically perfect, it is seen that the problem was a severe test for the merits of clay bond. When it is further realized that rejections during the period of the use of clay have not increased and that quality has not suffered, but in many instances has actually improved, it would seem that clay bond, intelligently employed with the American Foundrymen's association sand tests, offer definite possibilities to the foundrymen.

## Publishes Bulletins

Three bulletins have been published by the bureau of standards. One gives the annual report of the bureau and includes a summary of the various investigations completed or underway. This bulletin is miscellaneous publication No. 75. The other two are master specifications for refractories, fireclay, plastic, and for fireclay. These specifications primarily are for the various departments and establishments of the government, but will be found useful to firms which purchase these materials. Master specification for refractories, fireclay, plastic is circular No. 297 and that for fireclay is circular No. 298.

## Appoints Representatives

Edwin L. Wiegand Co., Pittsburgh, manufacturer of electrical heating units, has appointed the following representatives: Jones & Manter, Boston; C. I. Hayes, Providence, R. I.; Industrial Engineering & Equipment Co., St. Louis, and the Harrison Sales Co., Seattle.

# He Tried Rambling But Prefers a Steady Job

WHEN and if ever Joseph F. Rothe, president the Jos. F. Rothe Foundry Co., Green Bay, Wis., decides to adopt a coat of arms after the manner of his remote ancestors in the fatherland, probably he will confine the colors on the various heraldic devices to the three which have been associated most intimately with him all the exceedingly long and numerous days of his life.

Only one of these is a primary color. Another is not a primary color, but is recognized as one of the colors of the spectrum. The third is neither a primary color nor is it included in the seven colors that are paraded in the rainbow, but it is a color that is linked more perhaps than any other with outdoor memories of boyhood. Combination of the three, red, green and brown suggest the quiet, friendly woods in the fall of the year.

The device will show a large and competent right hand, *rampant*, *rouge*, grasping a shovel *pendant*, *vert*, superimposed on the figure of a half inch riddle *couchant*, and colored a dark brown.

This happy color combination will be based first on the family name, and second on the name of the town in northern Wisconsin where the owner has spent practically all his life. The third color is a delicate tribute to the farm in Brown county, Wisconsin, where he was born June 26, 1860.

Young Joe never had any illusions about the world owing him a living. He went to school until he was 13 and did his share of the innumerable chores around the farm at the same time. Then he decided it was about time to think about standing on his own little feet to relieve his parents of further responsibility. Naturally, in the course of time the feet have expanded to some extent, but the confidence he reposed in them on that far away day when he set out manfully for the town of Green Bay, never has deceived him. At times the way has been long and the going has been rough, but they never have faltered. They carried him to the top of the hill long since and now easily maintain him in his position.

When 13-year old Joe arrived in Green Bay he found that the openings for a man of his capacity and inches were limited. Finally he accepted a position as bell boy in the First National hotel.

He gave the printing trade a whirl for a few months, but did not like it. Then in succession he tried the life of a sailor, a farm hand and a cookee in a lumber camp. In between these more or less permanent jobs he worked for brief periods at a multiplicity of forms of employment in a battle with the grim old wolf constantly waiting with a nose and two fore paws on the door sill.

Shortly after his sixteenth birthday Joe took serious thought of the manner in which his life was slipping away with nothing definitely accomplished. He decided to quit the grasshopper form of existence and settle down to something reasonably worth while. On Nov. 10, 1876 he entered the small jobbing foundry known as the East River Foundry, as an apprentice with the full intention of giving the business a fair trial before dropping it in favor of any other. He recently completed 50 years continuous connection with the foundry industry and has confided to a few intimate friends that the business shows reasonable evidence of being fairly permanent.

For a consideration of 35 cents a day well and truly paid in hand every Saturday night, Joe served an apprenticeship of four years and in that time became an all around foundryman. This fact may not seem so extraordinary when you reflect that in these dear old days, now alas gone beyond recall, 11 hours constituted the day's work. Take out your little pencil and figure it up. On a 300 working days in a year basis, Joe put in a total of 13,200 hours as compared with the 9600 hours put in by the modern apprentice working on an 8-hour daily basis for a four-year period.

At the close of his apprenticeship he took a post graduate course for three years in Chicago, Milwaukee and northern Michigan foundries. Then he returned to good old Green Bay and worked as a foundry foreman for nine years. In 1893 he rented a small shop and his general jobbing business prospered to such an extent that two years later he built a foundry for himself. In 1909 he incorporated the business and built a new shop 80 x 120 feet. In 1925 the capacity of the plant was doubled. Recently a considerable amount of new equipment installed rendered the foundry one of the largest and most modern in the northwest. Mr. Rothe's two sons are associated with him in the management of the business, but the lively and pleasant young fellow who established the business still has the last word. Sometimes he also claims the privilege of the first word. In the vernacular of the shop "What he says, kid, goes!"

# Milestones in Foundry Progress

*As Recorded in the January Issues of THE FOUNDRY, Thirty, Twenty and Ten Years Ago*

## 1897

HENRY HANSEN, who later was to become editor of THE FOUNDRY, contributed the leading article to the January, 1897 issue. He told of the difficulty of burning an addition to a casting. His ideas that velocity of flow and the temperature of the metal used were important, since have been supported.

* * *

The Western Foundrymen's association was busily engaged discussing the apprentice training problem. Martin Fox, P. W. Gates, Mr. Sorge and Mr. Frohman constributed to the discussion at the meeting in Chicago Dec. 18, 1896.

* * *

Much excitement prevailed in the daily papers concerning a suit against the cast iron pipe foundries, brought in Chattanooga and charging a trust.

* * *

*The cast iron pipe industry had gone through an exceedingly lean period with the keenest kind of competition accompanied by suspicion and price cutting that brought the selling figure in some cases below the cost of pig iron. The cessation of this condition and the insistence by several makers upon a price of $24 a ton for some pipe sought by the city of St. Louis precipitated the suit.*

* * *

The metric system was suggested in a paper prepared for the American Society of Mechanical Engineers.

* * *

*It is always the cope that nobody looks under that drops out.*

KRANK'S KORNER

* * *

RUTHLESS RHYMES

Rambling Jim was the gas-weld man,
A worker, fast but careless.
Overlooked a hole in the hydrogen can;
Now the back of his head is hairless.

A. V.

* * *

Old Nick, a competitor of the well known Pokey who borrowed his copy of THE FOUNDRY, "just to read the obituaries," is given a lesson on fake medicines for bad melts by Pokey's foreman, Tom Bowers. Nick never knew it was possible to make chilled car wheels without scrap grate bars.

* * *

Wonder if he ever struck any trouble from nails in the kindling used to start the cupola?

* * *

Edward Taylor & Son foundry in Tangier, Morocco, was described. Reported no market for cast iron lions in that part of Africa. The real beast was too close at hand to need any replicas.

### Faked Foundry Facts

Bring 'Er Up Easy

## 1907

NO. 28 Orange street, Newark, N. J., the birthplace of American malleable cast iron was described in the issue of January, 1907. Here Seth Boyden began the production of malleable in 1826. Through various successions, this original company has been continued and at present is the Barlow Foundry, Inc.

* * *

Bradley Stoughton's paper on foundry mixtures, prepared for the Pittsburgh Foundrymen's association, covered the influence of various elements on softness and strength of gray-iron castings.

Dud Dudley told of the practice of plunging an Irish potatio, on the end of a bar, into a ladle of metal to produce agitation and bring the slag to the surface.

* * *

Dumb Donald rises to inquire if a Bermuda onion, used in the same fashion would impart additional strength. Answer: Yes! Donald, but it would give the castings halitosis.

* * *

A. O. Backert became editor of THE FOUNDRY Jan. 1, 1907 a position which he held continuously until his death in 1925.

* * *

The Lakeside Malleable Iron Co., Racine, Wis. was doubling its capacity.

* * *

Jobbing foundries were reported closing on account of low prices obtaining for castings and rising cost of iron. No. 2 pig iron was selling for $25 a ton, valley, with No. 2 southern at $22.

## 1917

NONFERROUS castings for railway service were featured in the leading article for January, 1917. The plant described was the foundry of the Pennsylvania railroad at Altoona.

* * *

Joseph Harrington described the use of powdered coal in malleable shops, the article in January, 1917, being the sixth of a series.

* * *

*Noteworthy advance has been made in the installation of powdered coal equipment in the malleable industry during* 1927.

* * *

Strong advances in iron and coke prices, incident to the pre-war demand for castings was reflected in a review. With the opening of 1916. No. 2 southern was selling at $14.50, Birmingham, compared with $24 a ton at the end of the year. Other pig iron quotations in January, 1917 were No. 2 Chicago, $30; Buffalo, $35 and $31.95 Pittsburgh.

# The Shakeout

DAN M. AVEY, Editor

PAT DWYER, Engineering Editor
FRANK G. STEINEBACH, Associate Editor

CHARLES VICKERS, Nonferrous Editor
EDWIN BREMER, Associate Editor

## ¶ The Sweet Buy and Buy

AMERICAN foundrymen face the entering year with a large measure of confidence and a comfortable assurance of the future. All signs point to the passing of the post-war period of deflation and while all of the slack incident to over-capacity has not been absorbed, practically all those conversant with the industry feel that the turn of the tide has come. The past year has been better in point of volume of business as indicated by summaries of production figures available, than any since the Armistice was signed.. Gray iron foundries making specialties such as pipe, radiators and sanitary ware have prospered. Early summaries indicate that the output of malleable castings for 1926 will be the largest in the history of the industry. While the volume of castings sold has been greater, the margin of profit has been extremely narrow under the keen competition which existed last year.

THE close prices which have governed in the purchase of castings during the past year have been reflected in developments along technical and practical lines. Periods of close profits seldom produce radical changes or revolutionary advancement in industrial practices. This fact is supported by a consideration of 1926 in the foundry industry. Mechanical equipment has been watched closely and those installations of labor saving machinery which have been made, have had as their purpose the cutting of small items from the total of production costs.

TECHNICAL progress as reflected in the activity of associations and in the pages of foundry literature, also has been actuated in many instances by the same considerations of economy and lowering costs. Sand research which may be said to have passed the period of pure theory and to have been brought to a practical working stage, is a case in point. Several hundred foundries now are using the methods of sand testing and reclamation control presented by the American Foundrymen's association and its cooperating societies.

IN THE malleable foundries, a wider application of powdered coal to melting was noted during 1926. Steel foundry practice has shown few changes. Producers of gray iron castings, hedged about by competition from within and without their branch of the industry, have sought new outlets. Many have studied the use of special alloys or have adopted practices that give certain desirable properties such as greater strength or corrosion resistance, as a means toward increasing their sales.

AMID the universal expressions of optimism for the New Year are many from castings producers who find the outlook pleasant. One of the brightest spots in the horizon is the prediction that railway buying, so long delayed is about to make its appearance. Meantime, the American people are by no means ready to stop buying automobiles, furnaces, bathtubs, washers and the thousand and one necessities that a few years ago were not appraised as so essential.

## ¶ Auto Makers Shout Secrets

IN A recent address, Alfred Reeves, general manager of the National Automobile chamber of commerce, stated that the builders of automobiles are the only manufacturers who advertise their trade secrets. Their plants are open at all times to inspection by visitors. They shout their new discoveries and only while new developments are in the experimental stage is any secretiveness shown. In line with this policy is the fact that the automobile industry has not known a suit for infringement of patents for the past eleven years. All new patents are held in a pool and are made freely available to reputable manufacturers. A total of about 700 patents are so held, and in addition 122 standards have been promulgated by the Society of Automotive Engineers.

This is an outstanding example of co-operative effort of an entire industry.

# Trade Trends in Tabloid

QUIET prevailed in many lines of castings manufacture during the closing weeks of 1926. This is in line with the condition ordinarily encountered and is taken to indicate no approaching reduction in the comparatively large volume of business of the last quarter of the year. In fact, the general expectation is for a growth in castings demand in the early part of the new year. Malleable output has been larger during the past year than ever before, and the outlook for 1927 is favorable. A factor which probably will have a stimulating effect upon steel castings demand is the announcement of railway car requirements. The inquiries for cars now existent total more than 20,000. November car orders totaled 3925, the best total since June, but the purchases for the entire eleven months amounted to only 51,585. Automobile manufacturers have slackened off on castings orders, announcing inventory and contemplated changes in models as the reason. The Ohio State Foundrymen's association, through its secretary, A. J. Tuscany, reports the November melt of gray iron foundries at 86 per cent of normal for November, compared with 81.3 per cent for October. Stocks of materials on hand declined from 87 per cent in October to 82 per cent in November. Nonferrous operations stand at 76.2 per cent in November, compared with 81.8 per cent for the preceding month.

**RAW MATERIAL PRICES**

**Iron**

**Dec. 21, 1926**

| | |
|---|---|
| No. 2 foundry, Valley | $19.00 |
| No. 2 southern Birmingham | 20.00 |
| No. 2 foundry, Chicago | 21.00 |
| No. 2 foundry, Philadelphia | 23.26 to 23.76 |
| No. 2 foundry, Buffalo | 20.00 |
| Basic, Valley | 18.50 |
| Basic, Buffalo | 19.00 |
| Malleable, Chicago | 21.00 |
| Malleable, Buffalo | 19.00 to 20.00 |

**Coke**

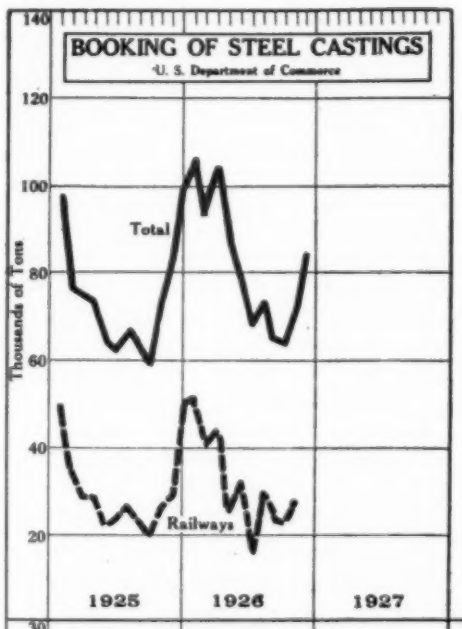
| | |
|---|---|
| Connellsville foundry coke | $4.50 to 5.00 |
| Wise county foundry coke | 6.00 |

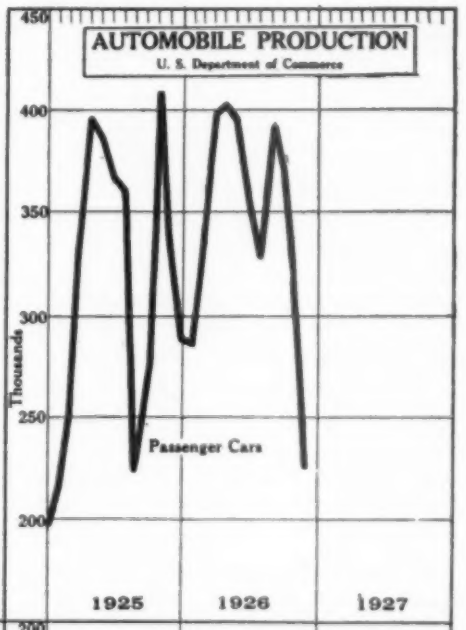
**Scrap**

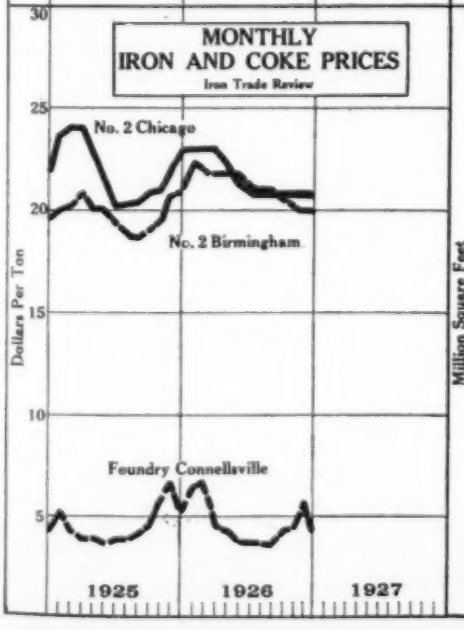
| | |
|---|---|
| Heavy melting steel, Valley | $16.00 |
| Heavy melting steel, Pitts. | 16.50 to 17.00 |
| Heavy melting steel, Chicago | 13.00 to 13.50 |
| Stove plate, Chicago | 14.00 to 14.50 |
| No. 1 cast, New York | 14.50 to 15.00 |
| No. 1 cast, Chicago | 16.50 to 17.00 |
| No. 1 cast, Philadelphia | 17.00 to 17.50 |
| No. 1 cast, Pittsburgh | 16.00 to 16.50 |
| No. 1 cast, Birmingham | 16.00 to 17.00 |
| No. 1 cast, Buffalo | 15.00 to 15.50 |
| Car wheels, iron, Pittsburgh | 16.00 to 16.50 |
| Car wheels, iron, Chicago | 14.75 to 15.25 |
| Railroad malleable, Chicago | 16.00 to 16.50 |
| Agricultural, mall., Chicago | 15.25 to 15.75 |
| Malleable, Buffalo | 17.00 to 17.50 |
| Railroad malleable, Pitts. | 17.00 to 17.50 |

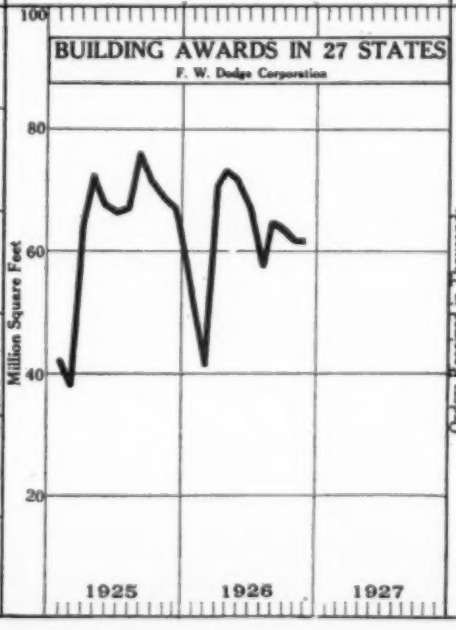
**Nonferrous Metals**

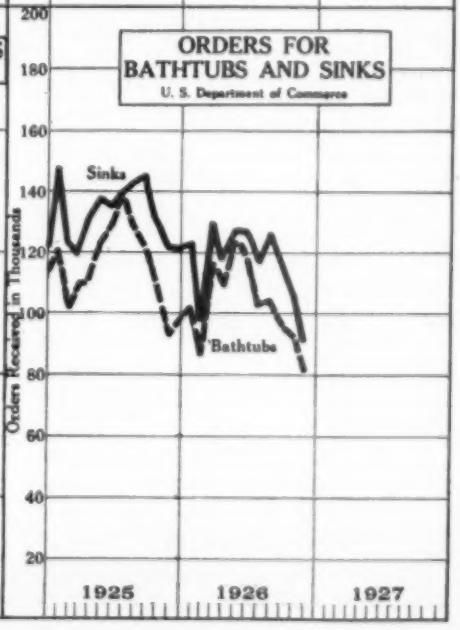
| | Cents per pound |
|---|---|
| Casting copper, refinery | 13.10 to 13.20 |
| Electro copper, producers | 13.60½ to 13.62½ |
| Straits tin | 68.50 |
| Lead, New York | 7.80 |
| Antimony, New York | 12.75 |
| Nickel, electro | 39.00 |
| Aluminum, No. 12, prod'rs | 25.50 |
| Aluminum, No. 12 remelt | 21.50 to 22.00 |
| Zinc, E. St. Louis, Ill. | 7.05 |



## Personal

William A. Harmon, who recently has been appointed foundry superintendent of the Crompton & Knowles Loom Works, Worcester, Mass., to succeed the late T. E. Cunningham, joined that organization as a molder at the age of 20 years in 1907. In 1917 he was made foreman of the upper foundry and held that position until his recent advancement. He has been an officer in the company relief association for several years.

Daniel Bynor has been appointed foreman of the foundry of the Lehigh Coal & Navigation Co., Lansford, Pa.

Stanley C. Hope has been elected second vice president of Gilbert & Barker Mfg. Co., Springfield, Mass.

John Udell, treasurer of the Muncie Malleable Foundry Co., Muncie, Ind., was elected a vice president of the Muncie chamber of commerce.

D. E. Anderson, formerly with the Cadillac Motor Car Co., Detroit, has become associated with the Bohn Aluminum & Brass Foundry Corp., Detroit, as sales engineer.

J. Robert Fortune is the newly appointed general sales manager of the Wickes Boiler Co., Saginaw, Mich., with headquarters in Detroit. Henry E. Aldrich has been appointed general manager with offices at Saginaw.

Walter W. Boley, formerly molder foreman with Taylor & Boggis Foundry Co., Cleveland, now is associated with the Pulaski Foundry & Mfg. Corp., Pulaski, Va., as foundry superintendent.

Louis J. Desparois has been made manager of the equipment plant, American Radiator Co., Buffalo. Mr. Desparois has been in the service of the company for 34 years. He was manager of the Kansas City, Mo., plant for 6 years previous to his recent appointment. J. F. Groebe succeeds Mr. Desparois at Kansas City.

G. C. Beishline has been appointed general superintendent of the Mt. Vernon Car Mfg. Co., Vernon, Ill., succeeding the late Charles Elliott. Mr. Beishline has been with the Mt. Vernon company for 12 years, going to that organization from the American Car & Foundry Co., Berwick, Pa.

Harrison Hoblitzelle has been elected vice president and director of the Commonwealth Steel Co., St. Louis. Mr. Hoblitzelle, who is 30 years old, is the youngest executive of any major steel corporation in that district. He is the son of the late G. K. Hoblitzelle, one of the organizers of the company. Mr. Hoblitzelle started with the company 8 years ago in a minor position after graduating from Cornell university, Ithaca, N. Y., in 1917. Before his election as vice president he was director of purchases.

## Announces Winners

Winners of the abrasive contest held by the Pangborn Corp., Hagerstown, Md., are as follows: John Knuth, foundry superintendent, Kohler Co., Kohler, Wis., first prize of $100; second prize of $50 divided beween E. F. Palmer, chief inspector and Tony Pizzino, both from the Massilion Steel Castings Co., Massillon, O., W. J. Palmer, foundry superintendent, Tennessee Coal, Iron & Railroad Co., Fairfield, Ala., third prize of $25. The contest was begun in Detroit at the Foundrymen's convention and continued until Nov. 30, and consisted in the ability to judge the abrasive used in cleaning a steel plate. The plate was divided into 10 segments which were finished differently.

## Elected Vice President

John S. Fletcher, assistant to the president, Harbison-Walker Refractories Co., Pittsburgh, has been elected vice president to succeed the late Hamilton Stewart.

## New Feature Planned

*WHILE quantity production without sacrifice of quality is the main goal of American foundrymen, in the field of metallurgy and foundry practice they are in the vanguard. Much of the progress in the foundry industry throughout the world has resulted from the investigations carried on in America. Co-operation and free interchange of information between foundrymen are responsible for the steady advance of the industry in America.*

*Nevertheless, the American foundrymen are seeking further knowledge and they delve into literature of many nations. To assist them and supply a guide to the latest and best articles from foreign journals* THE FOUNDRY, *on Jan. 15 will inaugurate a new feature page containing abstracts from English, German, French, Belgian and Italian publications.*

## Will Hold Short Course for Foundrymen

Under the auspices of the department of metallurgy college of engineering and the university extension division, the University of Wisconsin, Madison, Wis., proposes to conduct a short intensive course of foundry instruction extending over Feb. 1, 2, 3 and 4. The purpose of the course is to provide an unusual opportunity for foundrymen to pursue short courses of instruction covering the fundamental and basic principles and practices of the foundry, to learn what is new in foundry metallurgical research, to meet recognized authorities on foundry subjects.

As planned the course will cover six principal lines of activity: Cupola practice, molding and core sands, foundry costs, nonferrous metals, malleable castings, steel castings. The round table method will be followed in presenting the subject matter. A recognized authority will act as group leader and will have charge of the discussion. It is planned to hold the groups to a small number and in that way each man will be given ample opportunity to present his individual problem for discussion. In addition to the regular group meetings, laboratory demonstrations tests and exhibits will be arranged at convenient places in the various laboratories of the university. Parties also will visit foundries in Madison and vicinity. Any person interested may secure a program and any additional necessary information from Prof. E. R. Storey of the university.

## Buffalo Foundrymen Hear Cupola Discussed

On the evening of Dec. the Buffalo Foundrymen held a meeting in the club rooms at 140 Chandler street. The speaker for the meeting was R. H. Watson, metallurgist of the Semet Solvay Co., Detroit, who spoke on cupola practice. Many foundrymen were present to hear Mr. Watson's talk.

## Receives Appointment

A. W. Scarratt has been appointed assistant chief engineer of the Hyatt Roller Bearing Co., Newark, N. J. Prior to joining the Hyatt organization he was connected with the Minneapolis Steel & Machinery Co., Minneapolis for 13½ years. Mr. Scarratt was one of the organizers of the Society of Tractor Engineers

in Minneapolis which later became merged with the Society of Automotive Engineers. He served in many offices of the organization and now is secretary of the Minneapolis branch of the S. A. E. For 8 years prior to his association with the Steel company, Mr. Scarratt was connected with the Twin City Rapid Transit Co.

## Hear Lecture on Sand

At a meeting of the Newark Foundrymen's association held on Dec. 16, R. F. Harrington, metallurgist, Hunt-Spiller Mfg. Corp., Boston, outlined the activities of the joint committee on molding sand research of the American Foundrymen's association and the National Research council, and described the equipment used in various tests. Mr. Harrington said that sand analysis was as important as iron analysis and that many of the foundry troubles could be eliminated by careful attention to molding sand characteristics.

## Obituary

George Metzger, president of the Toledo Stove & Range Co., Toledo, O., and a leader in the industrial development of Toledo died recently at the age of 79 years.

William J. Wolf, treasurer of the Waterbury Farrel Foundry & Machine Co., Waterbury, Conn., died recently after an operation for appendicitis. He was 38 years old.

George Coombes, formerly manager of Kerr & Coombes Foundry Co., Hamilton, Ont., who died recently, was one of the founders of the firm bearing his name. He was a native of Sandown, Isle of Wight, England.

John Rainey McGinley, Pittsburgh, a pioneer in the natural gas industry in western Pennsylvania, died after an illness of several months. He was an associate of George Westinghouse with whom he formed the Westinghouse Electric & Mfg. Co., and the Westinghouse Air Brake Co.

William Corry, for twenty-two years vice president of the Chrome Steel Works, Carteret, N. J., died at Cincinnati Dec. 15 where he had made his residence since his retirement some years ago. Mr. Corry was 84 years of age. Prior to going with the Chrome Steel Works he had been superintendent of Herring-Hall-Marvin Co., safe manufacturers, Cincinnati.

Harry M. Giles, aged 70 years, general superintendent of the South Philadelphia works of the Westinghouse Electric & Mfg. Co., died recently at Swarthmore, Pa. He was well known in Pittsburgh, having been general superintendent of erection of the old Westinghouse Machine Co. Mr. Giles was born in Boothbay, Me. His work was in connection with the development of corliss steam engines, horizontal engines and turbine reduction gears for steamships.

George W. Neill, formerly president of the Neill Foundry Co., Portsmouth, O., died recently at the age of 75 years. He was born in Cincinnati May 25, 1851 and was brought to Portsmouth by his parents in 1853. Mr. Neill was educated in the public schools of Portsmouth and later attended Smith business college. While in his teens he became associated with his father in the stove foundry business and succeeded him at his death. Although the Neill foundry had ceased operations some years ago, Mr. Neill continued to receive orders for castings and mountings and by overseeing the work had the orders filled at local foundries.

John Francis O'Neil, former president of the Fulton Iron Works, died at his home here on Dec. 4 of complications attending old age. He was 70 years old. Born in Rockport, N. Y., Mr. O'Neil went to Dubuque, Iowa, when a young man going to St. Louis in 1888 as general superintendent of the Fulton Iron Works. He rose to vice president, and in the reorganization of the company in 1905 became its president. He resigned in 1917 and served a year as chairman of the board. In 1918 he organized the O'Neil Iron Works at Buffalo, which went into a receivership three years later. He is survived by his wife and a son, Lawrence W. O'Neil, president-treasurer of the Crescent Foundry Co., and two daughters.

# Foundry Association Directory

**American Foundrymen's Association**

President, S. W. Utley, Detroit Steel Casting Co., Detroit; secretary-treasurer, C. E. Hoyt, 140 South Dearborn street, Chicago; technical secretary, R. E. Kennedy, 909 W. California street, Urbana, Ill.

**The Buffalo Foundrymen**
**Buffalo**

President, J. McARTHUR, Washington Iron Works, secretary, W. J. WARK, E. J. Woodison Co., 146 Chandler street. Meetings the third Wednesday of the month at 146 Chandler street.

**Chicago Foundrymen's Club**
**Chicago**

President, CHARLES L. LARSEN, Armour Insitute of Technology, 3200 Federal street Chicago; secretary, ROGERS A. FISKE, 10 S. LaSalle street, Chicago. Meetings second Saturday in each month at the City club, 315 Plymouth court.

**Connecticut Foundrymen's Association**

President, FRED W. STICKLE, Capitol Foundry Co., Hartford, Conn.; secretary, C. S. NEUMANN, Union Mfg. Co., New Britain, Conn. Meetings are on second Friday of each month in various parts of the state.

**Detroit Foundrymen's Association**
**Detroit**

President, ROBERT G. CRAWFORD, Atlas Foundry Co., 131 South Artillery street, Detroit; secretary, RUSSELL M. SCOTT, Packard Motor Co., 1580 East Grand boulevard, Detroit. Meetings third Thursday in each month at the Union League club, 35 Grand River avenue, Detroit.

**Metropolitan Brass Foundry Association**
**New York**

President, THOMAS HARPER, Thomas Harper, 204 Lafayette street, New York; secretary WM. E. PAULSON, Thomas Paulson & Son Inc., 97 Second avenue, Brooklyn, N. Y. Meetings second Wednesday in each month at the Building Trades club, 34 West Thirty-third street, New York.

**Newark Foundrymen's Association**
**Newark, N. J.**

President, J. L. CARTER, Barlow Foundry, Inc., Newark; secretary, W. H. MANTZ, Atlas Foundry Co., Irvington, N. J. Meetings called by president.

**New England Foundrymen's Association**

President, H. P. BLUMENAUER, Arcade Malleable Iron Co., Worcester, Mass.; Secretary, FRED F. STOCKWELL, 205 Broadway, Cambridgeport, Mass. Meetings second Wednesday of each month at the Exchange club, Boston. Outings usually are held in the summer months.

**Ohio State Foundrymen's Association**

President, WALTER L. SEELBACH, Walworth Run Foundry Co., 2488 West Twenty-seventh street, Cleveland; secretary-manager, ARTHUR J. TUSCANY, 5713 Euclid avenue, Cleveland.

**Philadelphia Foundrymen's Association**
**Philadelphia**

President, WALTER WOOD, R. D. Wood & Co., Philadelphia; secretary HOWARD EVANS, J. W. Paxson Co., Luzerne and D streets, Philadelphia. Meetings the second Wednesday of each month at the Manufacturers' club.

**Pittsburgh Foundrymen's Association**
**Pittsburgh**

President, LAWRENCE V. STEVENS, Locomotive Stoker Co., N. E. Pittsburgh; secretary-treasurer, WM. J. BRANT, Wm. J. Brant, Bessemer building, Pittsburgh. Meeting on the third Monday of the month, except in July and August, at Fort Pitt hotel.

**Quad-City Foundrymen's Association**
**Davenport, Iowa**

President J. H. DIEDRICH, Blackhawk Foundry & Machine Co., Davenport, Iowa; secretary-treasurer, A. D. ZIEBARTH, Davenport Foundry & Machine Co., Davenport, Iowa. Meetings the third Monday evening of each month, the meeting place being rotated between Moline, Rock Island and Davenport.

**Southern Metal Trades Association**
**Atlanta, Ga.**

President, GEORGE B. COCKER, Gastonia, N. C.; secretary-treasurer, W. E. DUNN JR., Healey building, Atlanta, Ga.

**Tri-City Technical Council**
**Moline, Ill.**

Chairman, H. BORNSTEIN, Deere & Co., Moline, Ill.; treasurer, MAX SKLOVSKY, Deere & Co., Moline, Ill. Combined meetings held only one or two times a year on call.

**Tri-State Foundrymen's Association**
**Cincinnati**

President, HAROLD P. RITTER, John A. Oberhelman Foundry Co., 3323 Colerain avenue; secretary, GEORGE W. PIEHL, Wessling Bros. Foundry Co., 1607 McLean avenue. Meetings the second Thursday of each month at the Cincinnati club, Eighth and Race streets.

**Twin City Foundrymen's Association**
**Minneapolis-St. Paul**

President, J. A. TEACH, Minneapolis Steel & Machinery Co., Minneapolis; secretary-treasurer, C. E. LANGDON, 3849 Lyndale avenue, So., Minneapolis. Meetings monthly at the Athletic club.

## Builds Line of Grinders

A new line of grinding machines recently has been placed on the market by the Ransom Mfg. Co., Oshkosh, Wis. This line is made in several sizes, one of which is shown in the accompanying illustration. Any desired speed may be obtained with this grinder and any make of motor using either alternating or direct current may be used. The spindles are exceptionally large and run in ball bearings.

The rest brackets are removable so that large castings may be ground. The brackets are adjustable up and down. Fabricated steel guards conforming to accepted specifications are used. The motor is screwed to a table in the base. This table is raised and lowered by a scew, which may be noted in the front of the machine. This screw acts as a tightner for the belt. The machine also is supplied for operating rubber bond wheels at 9000 to 10,000 feet per minute periphery speed.

## Develops Dust Filter for Exhaust Systems

The Whiting Corp., Harvey, Ill., recently has developed a dust filter for removing dust from exhaust systems. The filter consists of a steel housing divided into two compartments by an assembly of wood frames covered with filter fabric. The dust laden air enters one compartment and is directed against a baffle which spreads the incoming air to fill the entire compartment. This reduces the velocity of the air and allows the heavier particles of dust to fall by gravity into a hopper. The fine float dust is carried by the slow movement of air against the filter fabric and while the air passes through the fabric, the dust remains on the filter fabric until removed by a gyratory vibrator.

Each filter frame is mounted individually and is sealed separately in the housing so that any filter frame may be removed for repairs without disturbing the adjacent frames. There are four filter frames for a foot of housing length, making each filter frame 3 inches wide. The frames are constructed to permit 1½-inch spaces between frames on the entry side so that the dust may drop from the filter fabric. A dust discharge valve is mounted at the base of the hopper. This valve is a cone-poppet valve and is sealed on a flexible rubber ring engaging the inside of the lower portion of a cone.

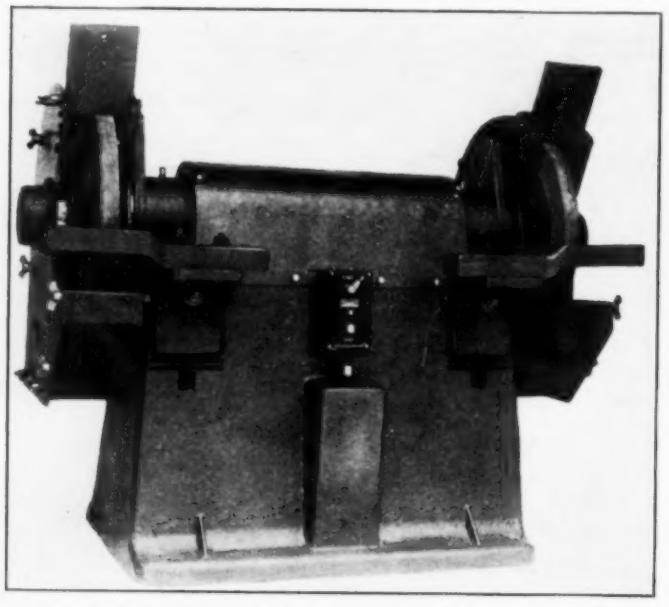
To eliminate the chafing action of the cloth against the frame, the filter frames are padded with heavy round jute pads which hold the filter fabric a sufficient distance away from the wood members of the frame. The fabric is sealed into the filter frame with a heavy cord in a slot. The filter fabric is wrapped around the intake side of the frame and is clamped fimly at the discharge end of the frame. Bolts extend through the frame sufficiently to hold the vibrator bar to the frame. A special gyratory virbrator and rapping bar is applied to the filter frame. All seams and joints in the housing are sealed tightly against leakage of air and against rain by gaskets, which are bolted in the seams when the housing is assembled. Large inspection doors, 18 inches wide and 48 inches high, are provided. The distance from the lowest point of the dust hopper valve to the top of the roof seams is 12 feet 3 inches. The maximum height from the bottom of the dust valve to the ground level with standard supports is 10 feet 9 inches. A view of the filter is shown in the accompanying illustration.

## Purchases Company

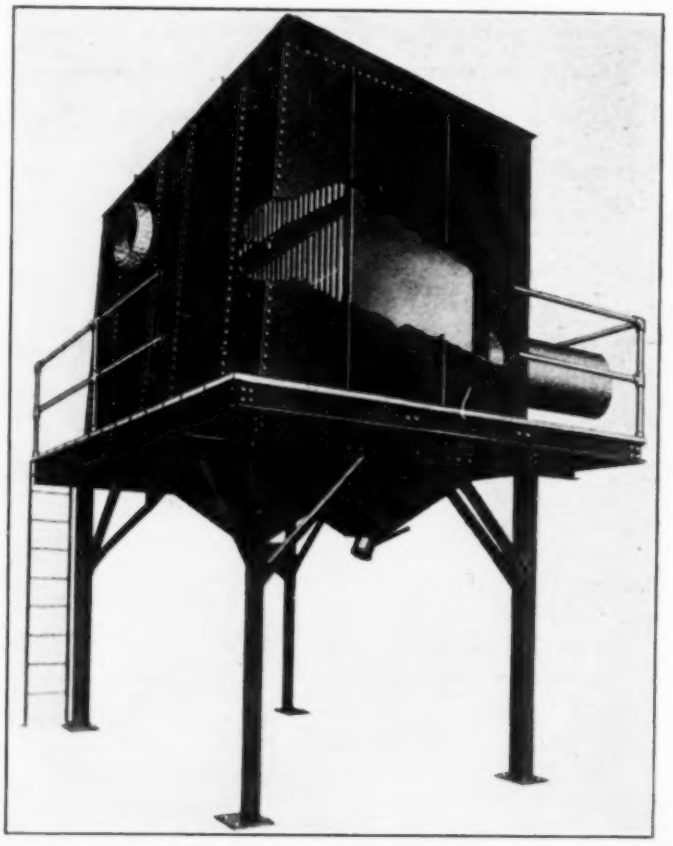
Dayton Greenhouse Mfg. Co., Dayton, O., manufacturers of greenhouse supplies and ventilating equipment, has purchased the plant and patent rights of the T. J. Callahan Co., Dayton. The firm is headed by Herman F. Gerdes, president and general manager. O. W. Bloom, W. B. Stewart, Joseph Westendorf and John Westendorf are directors and members of the board.

## Makes Personnel Changes

J. H. Ridge has been appointed branch manager at Pittsburgh and G. G. Weston has been appointed branch manager at Omaha, Nebr., by the Timken Roller Bearing Service & Sales Co., Canton, O.



THE TABLE HOLDING THE MOTOR IS ADJUSTED EASILY



EACH FILTER FRAME IS MOUNTED INDIVIDUALLY AND SEALED SEPARATELY

# 1927 Prospects Are Bright

## Manufacturers Feel New Year Will See Increase in Volume of Equipment Buying — Sales for 1926 Show Approximately 20 Per Cent Increase

SALES prospects for 1927 appear bright to the manufacturers of foundry equipment. This optimistic feeling results from the substantial volume of exceptionally live inquiries which rapidly are approaching the closing stage and from the general indications of good business for the new year. Several substantial building programs are under way and a portion of the equipment for these new plants already has been placed.

The volume of business in 1926 gained in the neighborhood of 20 per cent over the total for the preceding year. As was the case in 1925, sales of equipment increased considerably in December. A feature of the month was the sale of approximately 100 tumbling barrels to the Buick Motor Co. for its new foundry. It is believed that the remaining equipment for the new plant will be purchased shortly after the first of the year.

Several manufacturers in the Cleveland territory reported a strong closing for the year. One builder enjoyed the largest volume of the year in December. Equipment for handling and preparing sand continues in good demand and interest in other lines is increasing.

Many buyers have been delaying purchases in the Pittsburgh territory. Plenty of inquiries have been pending for some time, and now that the holiday and inventory season is passed, action probably will be taken. The latter part of December, however, was marked by an absence of new inquiries. The Erie Malleable Iron Co., Erie, Pa., probably will purchase additional wheel foundry machinery; the Valley Mould & Iron Corp., Hubbard, O., and the Shenango Furnace Co., Sharpsville, Pa., are expected to bring out lists for their ingot mold plants; the Union Steel Casting Co., the McConway-Torley Co., and other Pittsburgh plants are understood to be planning additional equipment buying at an early date.

Foundry equipment market in New England has suffered the usual holiday dullness. Many foundries are inquiring for equipment for 1927, but recent sales have been scattered. The Capitol Foundry Co., Hartford, Conn., which recently burned with an estimated loss of $40,000, is preparing plans for a new foundry and will be in the market for new equipment.

Holiday and inventory seasons made sharp inroads into business in the eastern foundry equipment market. Few outstanding orders were noted during the past month and the bulk of the business has been for necessary replacements. Pending inquiry holds the promise of a revival early in the year.

### CHICAGO MARKET

#### Core Ovens

Auto Specialties Co., St. Joseph, Mich., battery of four gas fired core ovens; Indianapolis Electric Steel Co., Indianapolis, electric core oven from Young Bros. Co., Detroit.

#### Cranes

International Harvester Co., Rock Island, Ill., three 2-ton hoists from H. D. Conkey & Co., Chicago, through Page & Ludwick, Chicago.

#### Dust Arrester Equipment

Greenlee Bros. & Co., Rockford, Ill., from the Pangborn Corp., Hagerstown, Md.

#### Furnaces

Oil Well Improvement Co., Tulsa, Okla., one cupola from the Whiting Corp., Harvey, Ill.

#### Ladles

Western Electric Co., Chicago, helical worm geared ladles from the Whiting Corp., Harvey, Ill.

#### Molding Machines

Denver Rock Drilling Mfg. Co., Denver, one roll over type machine from the Herman Pneumatic Machine Co., Zelienople, Pa.

#### Sandblast Equipment

Caterpillar Tractor Co., Peoria, Ill., Maytag Co., Newton, Iowa, West Michigan Steel Foundry Co., Muskegon, Mich., from the Pangborn Corp., Hagerstown, Md.

#### Sand Preparing Equipment

John Deere Spreader Works, East Moline, Ill., sand separator and blender from the Royer Foundry & Machine Co., Wilkes-Barre, Pa., through Page & Ludwick, Chicago.

Traverse City Iron Works, Traverse City, Michigan, one sand mixer and screen, Almont Mfg. Co., Almont, Mich., sand mixer and elevating equipment, Edison Electric Appliance Co., Chicago, one mixer, from the Standard Sand & Machine Co., Cleveland.

#### Shakeout Equipment

Emerson-Brantingham Co., Rockford, Ill., Campbell, Wyant & Cannon Foundry Co., Muskegon, Mich., Ypsilanti Foundry Co., Ypsilanti, Mich., vibrator and shakeout equipment; American Foundry Co., Indianapolis, Ind., knockout equipment from the Stoney Foundry Engineering & Equipment Co., Cleveland.

#### Tumbling Barrels

Buick Motor Co., Flint, Mich., 92 tumbling barrels from the Whiting Corp., Harvey, Ill.

### PITTSBURGH MARKET

#### Ladles

Allegheny Steel Co., Brackenridge, Pa., one 10-ton worm geared ladle, Titusville Iron Works, Titusville, Pa., one 3-ton helical worm geared ladle from the Whiting Corp., Harvey, Ill.

#### Sandblast Equipment

Vulcan Iron Works Co., Wilkes-Barre, Pa., Standard Engineering Co., Ellwood City, Pa., from the Pangborn Corp., Hagerstown, Md.

### NEW ENGLAND MARKET

#### Cranes

Howe Scale Co., Rutland, Vt., one 3-ton electric traveling crane from the Shepard Electric Crane & Hoist Co., Montour Falls, N. Y.

#### Molding Machines

Hunt-Spiller Mfg. Corp., Boston, one roll over machine from the Herman Pneumatic Machine Co., Zelienople, Pa.

#### Miscellaneous

General Electric Co., Lynn, Mass., one 3-ton electric cupola charger with bottom dump charging buckets from the Shepard Electric Crane & Hoist Co., Montour Falls, N. Y.

### NEW YORK MARKET

#### Dust Arrester Equipment

Northwestern Foundries, Inc., Rochester, N. Y., from the Pangborn Corp., Hagerstown, Md.

#### Ladles

Eastern Steel Castings Co., Newark, N. J., three helical worm geared crane ladles from the Whiting Corp., Harvey, Ill.

#### Sandblast Equipment

South Australian Railways Co., Sydney, Australia, Crowes Iron Works, Ltd., Guelph, Ont., from the Pangborn Corp., Hagerstown, Md.

#### Sand Preparing Equipment

D. P. Fisher Ltd., Wellington, New Zealand, sand mixer with screen from the Standard Sand & Machine Co., Cleveland.

### CLEVELAND MARKET

#### Dust Arrester Equipment

Ensign Foundry Co., Toledo, O., from the Pangborn Corp., Hagerstown, Md.

#### Furnaces

Detroit Gray Iron Foundry Co., Detroit, one cupola from the Whiting Corp., Harvey, Ill.

#### Molding Machines

Worthington Pump & Machinery Corp., Buffalo, one 8 x 12 foot roll-over machine from the Herman Pneumatic Machine Co., Zelienople, Pa.

#### Sandblast Equipment

Detroit Lubricator Co., Detroit, from the Pangborn Corp., Hagerstown, Md.

#### Sand Preparing Equipment

A foundry in Zosembru, Japan, small sand mixer from the Standard Sand & Machine Co., Cleveland, through Metsui & Co., New York.

Crucible Steel Casting Co., Cleveland, Light Alloys Co., Painesville, O., sand separators and blenders from the Royer Foundry & Machine Co., Wilkes-Barre, Pa., through the Mayor Fuel Saving Furnace Co., Cleveland.

#### Shakeout Equipment

Modern Foundry Co., Cincinnati, vibrator and shakeout equipment; Henry Furnace Co., Medina, O., knockout equipment, from the Stoney Foundry Engineering & Equipment Co., Cleveland.

# What the Foundries Are Doing

## Activities of the Gray Iron, Malleable, Steel and Brass Shops

Coleman Hardware Co., Dwight, Ill., will rebuild its burned pattern department.

A. & J. Mfg. Co., Gadsden, Ala., will build an addition to its main foundry 80x100 feet and warehouse 80x130 feet.

United Casting Co., 824 Wilson street, Los Angeles, will build a 1-story foundry 40x60 feet.

Peninsular Stove Co., Detroit, is having plans drawn by Albert Kahn, architect, for a new factory building. (Noted Nov. 15, 1926)

Hillsdale Plow Co., Hillsdale, N. Y., will rebuild the burned portion of its plant. William A. Mallory Jr., is president.

Capitol Foundry Co., Hartford, Conn., F. W. Stickle president, will rebuild burned portions of its plant.

Keeley Stove Co., Columbia, Pa., will build a 3-story addition to its plant for which additional equipment will be required.

Bartlett-Hayward Co., 200 Scott street, Baltimore, intends to build two 1-story additions 26x28 feet and 48x56 feet. General contract to Morrow Bros., Fidelity building.

American Brass & Iron Co., Detroit, will remove its operations from 6435 Crystal street to the Twelfth Street Terminal building where it will increase its facilities for production.

Charleroi Steel & Foundry Co., Charleroi, Pa., John K. Tener president, has made arrangements for a plant which it will equip and start production shortly.

William Moulds Foundry Co., Benton Harbor, Mich., manufacturer of brass and bronze castings will build a 1-story addition to its plant.

Lakey Foundry & Machine Co., Muskegon, Mich., Herman A. Becker president and general manager, will rebuild burned portion of its plant.

Gillen & Harder Brass Foundry, New York, has been incorporated with 100 shares no par value by W. Gillen, A. Gillen and H. Harder. J. T. Booth, 233 Broadway, is attorney.

Builders Iron Foundry Co., 9 Codding street, Providence, R. I., Z. Chafee president and treasurer, is considering revised plans for a 1-story foundry, previous bids being rejected. (Noted Dec. 1, 1926)

United States Cast Iron Pipe & Foundry Co., Chattanooga, Tenn., is having plans sketched for a new plant on its Tannery Flats site. A crane building is being erected on this site at present.

Danville Iron & Steel Co., Danville, Pa., F. O. Reedy, superintendent, will convert steel mill building into a foundry to replace one recently burned. Modern equipment will be installed.

Standard Car Wheel Co., 6701 Bessemer avenue, Cleveland, recently bought by the Griffin Wheel Co., Chicago, was damaged by fire and one building will be rebuilt, others repaired.

Buick Motor Co., Flint, Mich., will build a foundry plant with capacity of 500 tons per day on a 12-acre site. Pattern storage and cleaning buildings are now under construction.

Springfield Foundry Co., Springfield, Mo., W. P. Powell manager, Concord avenue and Phelps street, is building a new plant at 316 West Mill street which will be equipped with modern machinery.

Sprout Brass Foundry Co., Los Angeles, has leased three acres additional adjoining its plant from the Ward Heater Co., Samuel Sprout, president, and will build an addition to supply the latter with its brass requirements.

Acme Steel & Malleable Iron Works Inc., Buffalo, D. Carson president, 245 Military road, has let general contract to J. W. Cowper Co. Inc., 725 Fidelity building, for a 1-story factory addition 60x200 feet. (Noted Dec. 1, 1926)

DeMattia Foundry & Machine Co., 6 Monroe street, Clifton, N. J., manufacturer of machinery for rubber mills, will build two additions, one to be used as an assembly plant. Its new foundry 96x240 feet, has been completed.

Carolina Iron Co., Winston-Salem, N. C., has been incorporated as the successor to the Carolina Foundry & Machine Co., by C. M. Thomas, president. Will remodel and enlarge plant and equipment at Chestnut street and Southern railroad.

Gogan Machine & Foundry Co., J. Gogan president, 1630 Collamer avenue, Cleveland, is building a new plant at 1440 East Fifty-fifth street, to give larger production. It manufactures shaft heat-treating machines and spring forming and quenching machines, pump-driven bulldozers and bending machines.

Harris Automatic Press Co., Cleveland, Seybold Machine Co., Dayton, O., and the Premier & Potter Printing Press Co. Inc., New York, have been consolidated under the name Harris-Seybold-Potter Co. These companies have been manufacturers of printing presses and other machinery for printers, lithographers and publishers.

The Hammond, Ind., plant of the New York Car Wheel Co., Buffalo, has been purchased by the Southern Car Wheel Co., Pittsburgh, according to an announcement. No changes in the personnel of the Hammond plant are contemplated at this time. The Hammond plant adjoins the Standard Steel Car Co. works.

# New Trade Publications

CHEMICALS—Roessler & Hasslacher Chemical Co., New York, has issued a pamphlet containing a price list of various chemicals.

TRAMRAILS—Applications of its tramrail systems are shown in several folders issued by the Cleveland Crane & Engineering Co., Wickliffe, O.

NICKEL—The ninth of a series of bulletins on nickel steel recently has been issued by the International Nickel Co., New York. This bulletin presents the physical properties of nickel and nickel-chromium steels.

SILENT GEARS—A booklet by the General Electric Co., Schenectady, N. Y., covers its gears of material which reduce noise. Actual installations are pictured and the subject of gears is discussed.

MOTOR BASES—Pedestal bases for vertical motors are described in a bulletin by the General Electric Co., Schenectady, N. Y. Features making them adaptable to various uses are illustrated.

GRINDERS—A bulletin has been issued by the Cincinnati Grinders Inc., Cincinnati, O., describing its plunge cut grinders, the first description of this type of machine as developed by this company.

REFRACTORY CEMENT—Botfield Refractories Co., Philadelphia, has issued a booklet quoting extracts from letters from users of its fire brick cement, illustrated by applications of the cement in various installations.

ALLOY STEEL—A special steel capable of being case-hardened at low temperature without deformation is described in a pamphlet by the Ludlum Steel Co., Watervliet, N. Y. It is illustrated by halftones of automotive parts made from this metal.

BOXES AND PLATFORMS—Truscon Steel Co., Youngstown, O., has issued a booklet describing its alloy steel boxes and platforms for various industrial uses, illustrated by many types of these products and actual installations. Foundry flasks of the same materials are shown.

HEAT INSULATION—General Insulating & Mfg. Co., Alexandria, Ind., has issued a catalog describing a natural calcium silicate rock which is mined by the company and fabricated into insulating material. Characteristics of the insulating material and its application are given.

TRANSFORMER TAP CHANGERS—A bulletin by the Wagner Electric Corp., St. Louis, describes and illustrates its devices for changing taps quickly and conveniently in any kind of weather. Features are included to prevent incomplete change of taps and the device can be locked to prevent any but authorized hands gaining access.

RUST PREVENTION—Causes of corrosion of iron and steel surfaces and suggestions as to means to prevent it are contained in a booklet issued by the Quigley Furnace Specialties Co. Inc., New York. Coatings designed to prevent the start of corrosion and to protect metal surfaces against the action of atmosphere and acid fumes are described.

WELDING HEAD—General Electric Co., Schenectady, N. Y., has issued a bulletin describing an automatic welding head and control. It describes the device and illustrates its parts and operation. The electrode is touched automatically to the work and immediately withdrawn to form the arc. The action of the machine is described as more rapid and accurate than the best hand work.

MOTOR CONTROL—A control system for direct-current motors is described and illustrated in a current bulletin of the General Electric Co., Schenectady, N. Y. This is a type of controller first developed for use in conection with motors driving rolling mills, its use has been expanded to include many other applications. Full details of the controller and its parts are presented in illustration and text.